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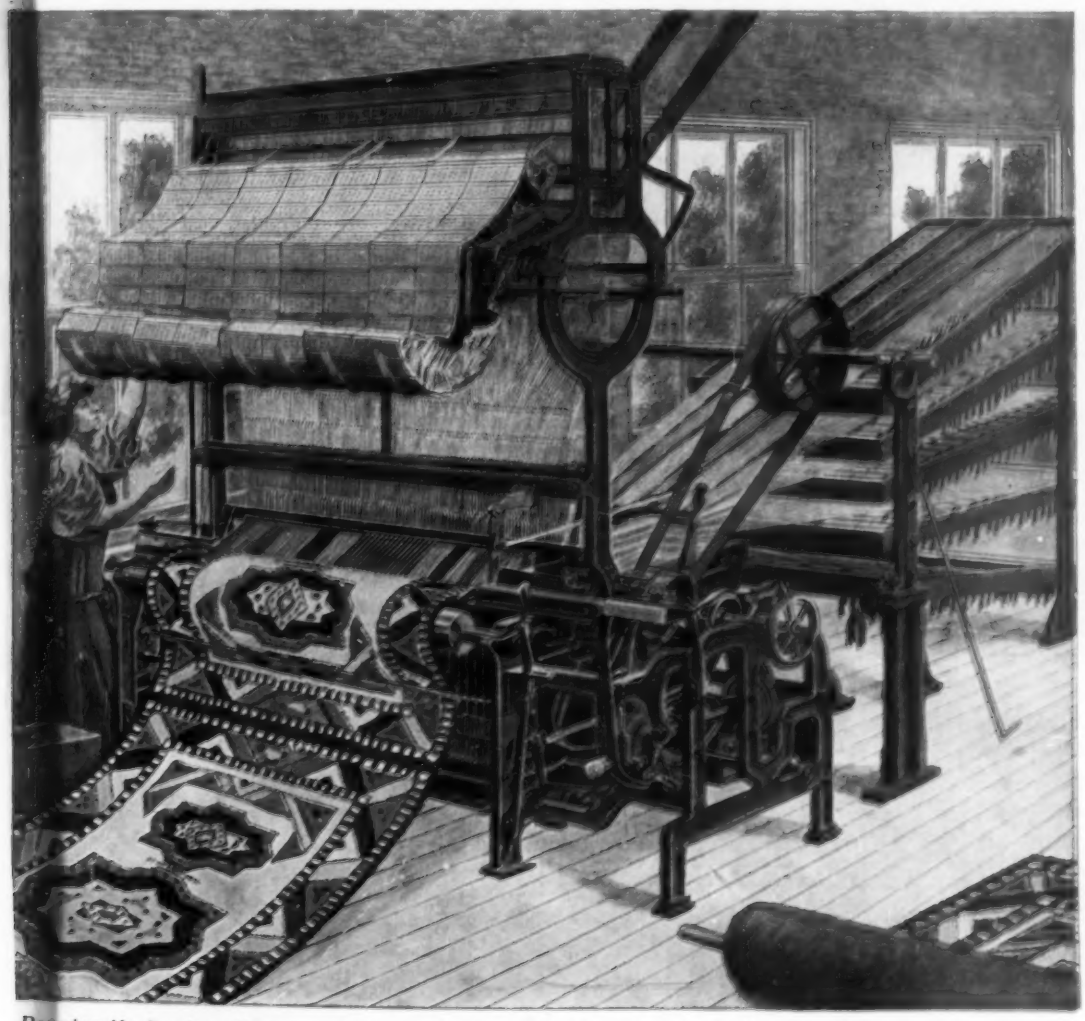

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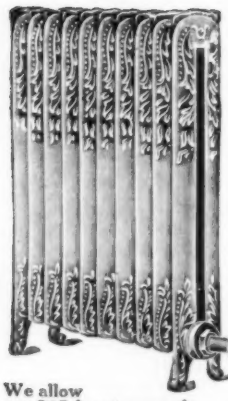

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Our prices on first class brand new Hot Water and Steam Heating Apparatus are lower than you can possibly obtain anywhere else. All we ask is for an opportunity to demonstrate the absolute truth of this statement.

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We can furnish you all the necessary apparatus for the installation of either a Hot Water or a Steam Heating Plant in your building, whether it be new or old at a saving of from 30 to 50 per cent. We ask that you furnish us a sketch of the building you have to heat, and supply us with such additional facts regarding its construction as will intelligently enable us to understand all conditions. Upon receipt of such information we will prepare a proposition covering the material you need to correctly install the plant. We will make you a price on application that will be freight prepaid in full to your shipping point.

We Furnish All Necessary Instructions

Including Blue Prints, Sketches and Drawings. Any ordinary mechanic can install these plants

Our proposition will include all necessary blue prints, sketches and detailed drawings, so that any man handy with the use of tools and possessing average intelligence can easily install the plant. We will also loan you the necessary tools.

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Chicago House Wrecking Co., Chicago, Ill.
Dear Sir: — I have my heating plant installed and it works fine. Can heat my place red hot if I want to.
Yours very truly, (Signed) L. A. NEFF.

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Chicago House Wrecking Co., Chicago, Ill.
Dear Sirs:—The heating plant you sent me is installed and is working fine. Everything is entirely satisfactory in every way. Wishing you entire success, I remain,
Yours truly, PAUL H. FITZGERALD

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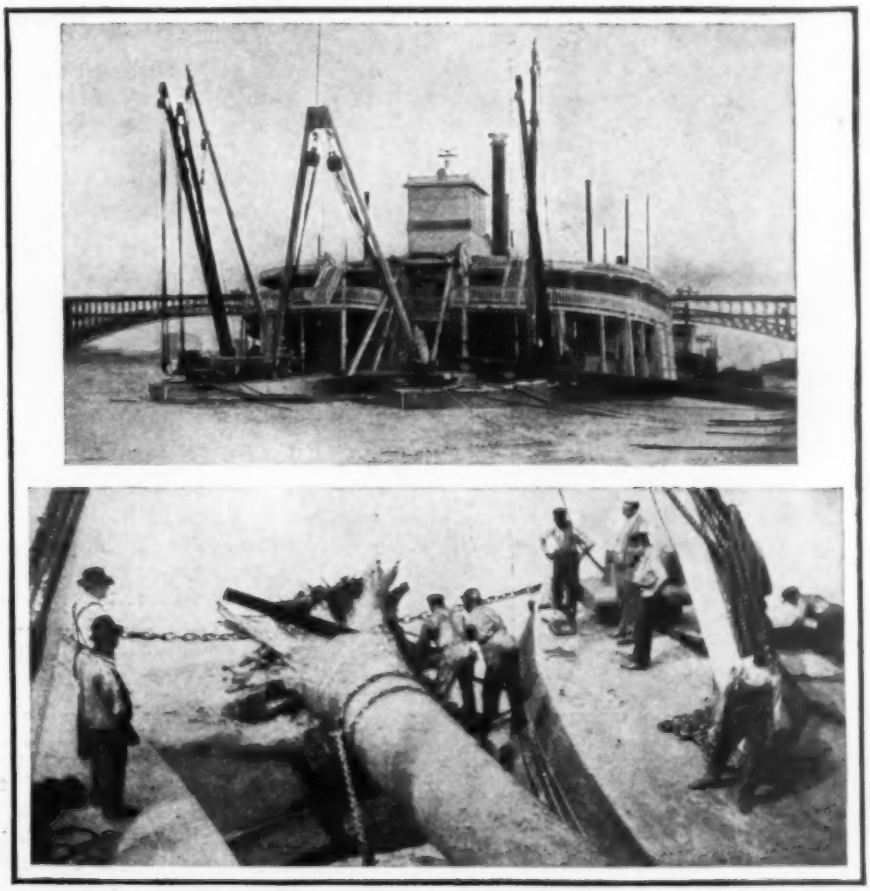
Popular Mechanics

Written So You Can Understand It

Vol. 13 FEBRUARY No. 2

HOW UNCLE SAM KEEPS RIVERS FREE FROM SNAGS



One of the Big Mississippi River Snagboats, and the Crew Pulling a Big Tree Trunk Out of the Stream

To keep the rivers free from snags and other dangers to navigation the federal government maintains a fleet of more than 30 steamboats at a cost of about half a million dollars a year. These snagboats are of three different kinds, the largest, used exclusively for snagging, patrol the lower Mississippi

On Top of a Philadelphia Church Spire

and lower Missouri rivers. They are the "Wright," the "Macomb" and the "Missouri." They have steel hulls, with double bows and are 187 ft. long, the two former being 82 ft. beam and the latter 72 ft. Smaller types of boats have a spoonbill bow and are used for occasional towing jobs, while a third type, used on the smaller rivers is a combined snag and dredge boat and can also be used for towing. Some snags, submerged trunks of trees, etc., are 5 and 6 ft. in diameter and would sink a steamboat easily. The larger boats, equipped with powerful machinery to cope with them, are, in fact, floating machine shops. Each is equipped with 32 engines, besides complete machine, blacksmith and carpenter shops for repairs. They carry a crew of fifty men each and are in active service most of the time.

MEXICAN SCHOOLS OF RAILROADING

Since the acquisition of railway lines by the Mexican government, six training schools have been established in the City of Mexico and other cities of the country for the purpose of teaching railroading. The students are taught telegraphy, locomotive engineering, and the work of conductors. The term of school for a student is one year, after which he is given an opportunity for practical experience on a real train. Such positions have been and still are mostly held by American railroad men of ability.

TWO REMARKABLE STEEPLE-JACK ACCOMPLISHMENTS

Although the work of the steeplejack is so dangerous that but few men desire it as a vocation, and spectacular enough at all times to make the ordinary human being gasp, many steeplejacks have made lasting reputations by more daring feats than are actually required to accomplish the work in hand.

Such a feat is shown in one of the illustrations, a photograph taken while Hassler, the Philadelphia steeple-jack

was balancing himself on one foot upon the top of a pole that rises 250 ft. above the street level of New York. The other illustration shows the same steeple-jack standing upon the top of a spar several feet higher than the spire's very pinnacle, and gives some idea of the frail-looking but strong scaffolding required for steeple work.

The spire is that of St. Mark's Episcopal church in Philadelphia, and the nature of the work was the removal of some stones near its top and the rebuilding and placing of a new finial.

The spar on which Hassler is standing was required as a support for the handling of the heavy capstone, and is about 185 ft. above the ground.

Anyone can clearly see by the photograph how the steeple-jack gets back and forth from one of the windows of the spire to its top, but how he succeeded in getting the scaffolds and Jacob's ladder in position in the first place would puzzle the majority of readers. The first climbing is done by the aid of three or four pieces of rope, termed "lashings," and the climber makes one of these lashings fast, then stands upon it while making fast the one above it, in this way continuing his dangerous feat until the pinnacle of both the spire and his desire is reached. The scaffolding consists of four triangular braces.

Balancing on One Foot at Top of 250-Ft. Pole

ONE BLAST PROVIDES 120,000 CUBIC YARDS OF ROCK

The blasting of an extraordinary amount of rock from a mountain side is always interesting, and this is doubly so because of the unusual success of the blast from all standpoints. Its purpose was to provide loose rock for the construction of the Morena dam in California. Something like 100,000 cu. yd. was required, and believing that one blast would not provide more than 50,000 cu. yd., preparations were under foot for a second blast sometime later.

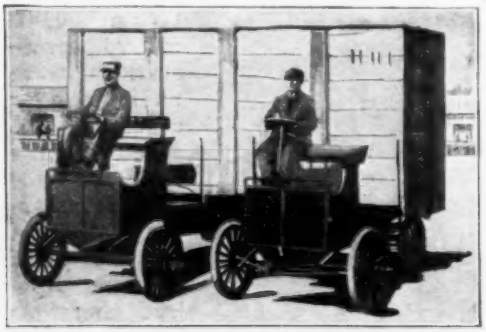
The measure of success of the blast can be realized therefore by the fact that the rock actually brought down was 120,000 cu. yd., which made a second blast quite unnecessary. Direct into the straight face of the hard granite rock a tunnel was driven a distance of 125 ft., and from this led two short side drifts. Above the tunnel the rock rose to a height of 150 ft. In the side drifts were placed 33,550 lb. of champion powder, 2,000 lb. of 60 per cent dynamite, and 3,400 lb. of 40 per cent dynamite. Three 20-ft. electric fuzes, connected in series, were used to explode the charge. The side drifts and main tunnel were well tamped with fine dirt, and all of the main tunnel filled with earth and rock

to within 20 ft. of its mouth. The battery was connected to the tunnel wiring by 500 ft. of double-lead wire.

During the placing of the charge, the men were required to surrender matches and smoking material, and their feet, from which the shoes had been removed, were covered with padded sacking.

TWO AUTO TRUCKS FOR ONE LOAD

The two automobile trucks shown drawing one load in this illustration



Load That Taxes Two Autos

are put to this use regularly by the concern that manufactures them. The load is an automobile boxed for a long journey. Much skill is required by the drivers of the two trucks in steering their way along the road, and especially in turning corners.

"S 5 S" RIVALS "C Q D" FOR WIRELESS HONORS

"S 5 S" was the message of distress which flashed through the air over Lake Michigan from the steamer "Puritan," struggling in a heavy sea, with her rudder gone.

This message is fraught with the same significance as the now famous "C Q D" which Jack Binns sent out to call aid to the steamship "Republic," yet, not until the former sprang into prominence in connection with the "Puritan" wreck did the public know of its existence.

"S 5 S" is the American code signal of distress. "C Q D" is the Marconi code call for help. They are used by the rival wireless companies. The combination of the letters in the American code call has no special significance, being merely a succession of dots and dashes quickly made and easily recognized, three dots, three dashes, and then three more dots, thus: ... - - - ...

The "C Q D" call was made up of the first letters of the words "Come—Quick—Danger."

The existence of the two rival companies having different codes was charged by an operator at Detroit, Mich., with being responsible for the loss of 14 lives on the steamship "Clarion" which was burned on Lake Michigan on December 8th. The Detroit operator declared that the operator on a steamer which was in sight of the "Clarion," and which flashed the distress signal, refused to answer and give the location of the burning steamer when he learned that an operator for the rival company was receiving the message.

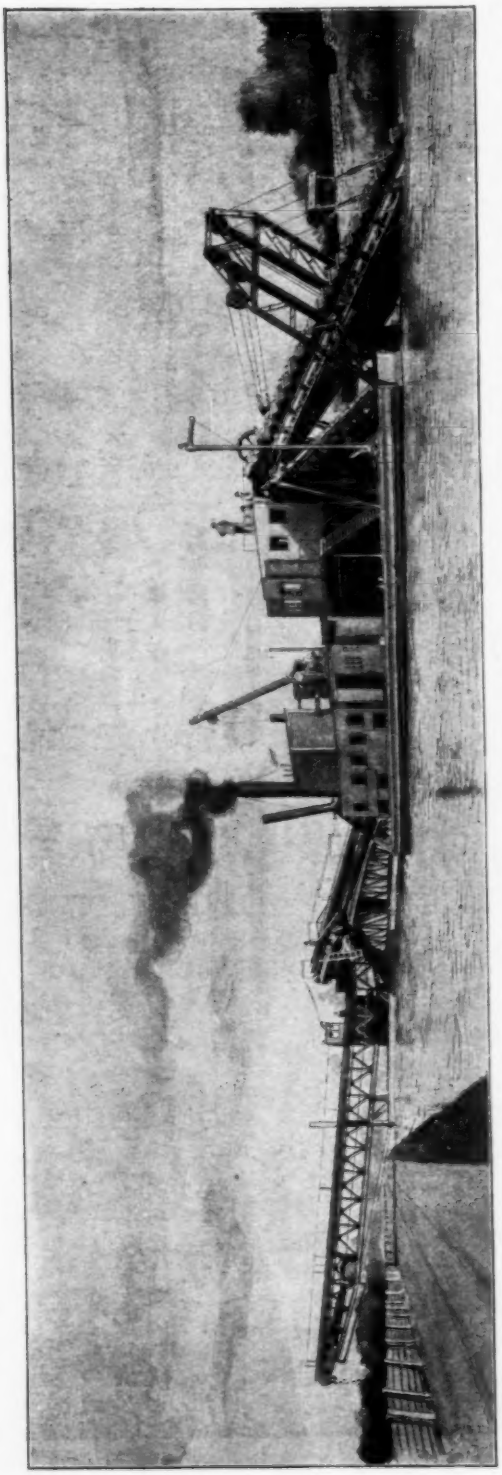
A WOMAN OF SMOKE

During a fire which attacked a wall-paper concern at Tenth avenue and Thirty-fourth street, New York, a photographer took several pictures of what he supposed were only ordinary smoke effects. Imagine his surprise, therefore, when, on developing his plates the head and figure of a woman, dressed in furs, was discovered in the very center of the smoke.

Upon the delicate but clear-cut nose is a pair of glasses, and the features and head of hair are perfect, the shading being as fine as though a real woman posed in a photograph studio. The figure is standing, with the hands clasped together below the waist, and she is robed in a fur coat of great thickness and softness.

A subway proposition, which will consist of 33 miles of underground railway, is to be submitted to the people of Toronto, Canada.

Curious and Artistic Smoke Woman



A WILD DRIVE FOR LOST GOLD SACKS

Driving in from the Round Mountain mine to Goldfield, Nev., in an automobile, the tonneau of which contained bags of gold dust worth $200,000, William Kennedy, a prospector, lost three sacks out of the car on the road. The sacks contained $65,000 in dust, and had slipped out. When he discovered his loss, Kennedy turned the machine around, threw on his high speed, and despite the rough road, pushed the machine for every ounce of power there was in it. It was the wildest, record-breaking run ever made in that section of the country. Twenty miles back the first sack was found on the road and the others were picked up a few miles beyond.

MOP MADE BY THE BLIND

A mop which is now having a large sale is one of the results of the efforts of workers among the blind to provide them with practical ways of earning a living. Invented by a totally blind man, it is patented and held for the blind, and in workshops conducted by the Massachusetts commission for the blind is manufactured by them.

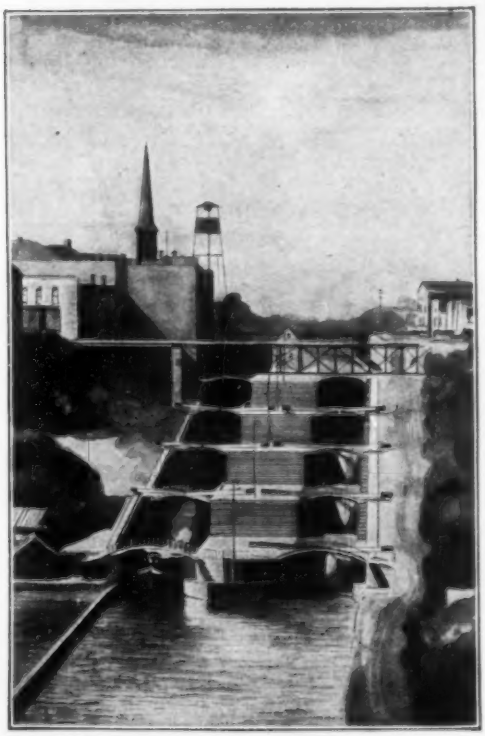
CONSTRUCTING THE NEW YORK STATE BARGE CANAL

Work is progressing rapidly on the $101,000,000 New York state barge canal. A popular vote in 1903 sanctioned this expenditure on the Erie, Oswego, and Champlain canals, which will now be known under the new title. Much has been written of the project, consequently this article simply deals with two features of the work.

One illustration shows the famous, five-combined, double locks of the Erie canal at Lockport, which are shortly to disappear forever and be replaced by two-combined single locks. The old locks were built entirely of stone. Each lock had a lift of 12 ft., making a total

of 60 ft. from the lower to the upper levels. The new lock will be built entirely of concrete and have a normal lift of 50 ft. The descent at this point is known to geologists as the Niagara escarpment, and is one of nature's strongest barriers to the enterprise. The plant for operating and illuminating the new lock will receive its power from the water at the highest head of the canal.

The other illustration gives an excellent idea of the type of bucket-dredge designed especially for excavation on the canal. It cost $75,000 and consists of two units—a dredger and a conveyor. Its capacity is 3,000 cu. yd. per day, and its 2-unit arrangement makes possible the conveyance of the material excavated quite a distance. The illustration shows the front end of the dredge in operation, the rear end



Old Five-Combined Double Locks at Lockport

placing the material on the separate conveyor, and the latter depositing it upon the shore.

GIANT MILLINERY CREATION

The manager of a Los Angeles, Cal., department store had this hat built for

A Hat 5 Ft. in Diameter

display in one of the show windows. Worn by a wax figure, it drew so much attention that an actress acquired it and wore it in the productions given in that city. It contained about $60 worth of material and was about 5 ft. in diameter, and because of this great size it goes without saying that as a theatre hat it was much more highly appreciated on the stage than if it had been worn by one of the audience.

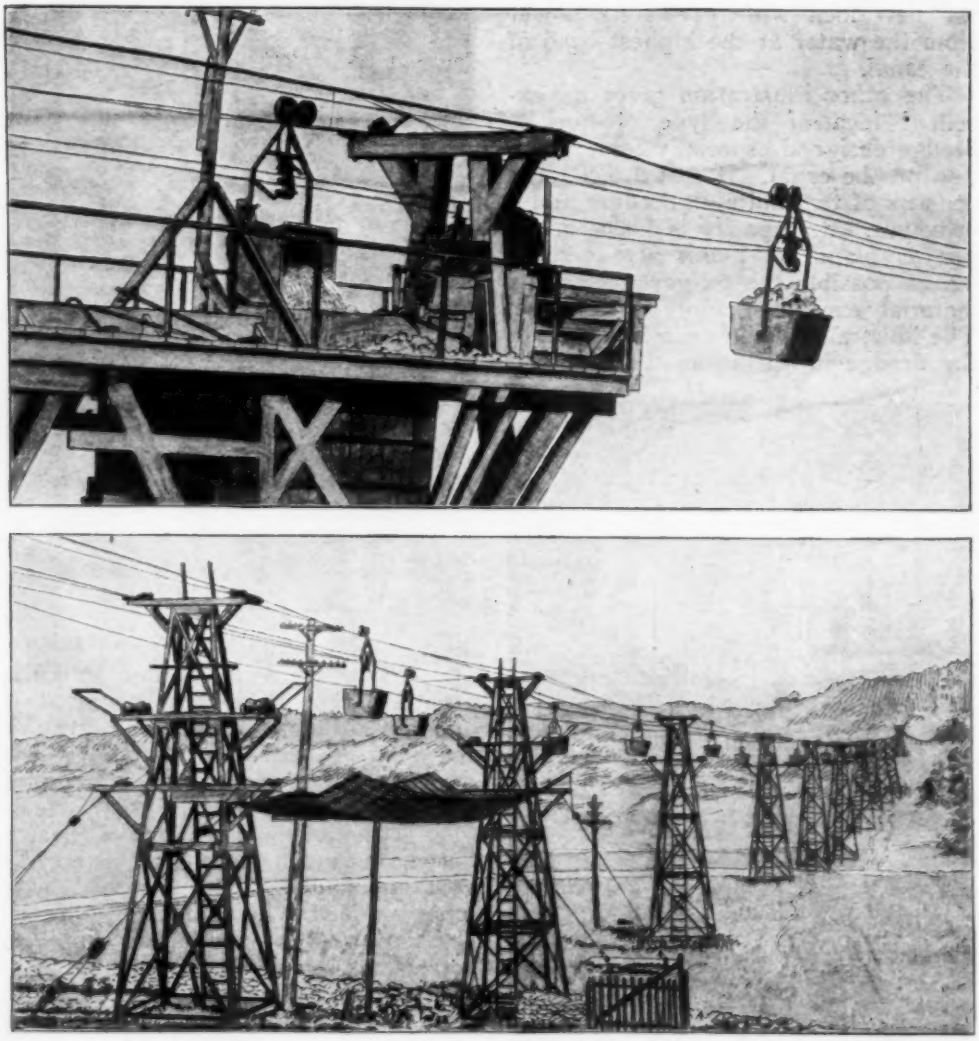
At the end of the play's run, the actress invited all her friends to partake of the hat, and the braid, ribbons, and flowers, all of fine quality, went into the construction of picture hats.

To run the "Lusitania" at a speed of 20½ miles an hour would only require a consumption of 350 tons of coal a day, or 2,246 tons, as compared to the 4,725 required for the trip at a speed of about 30⅓ miles an hour.

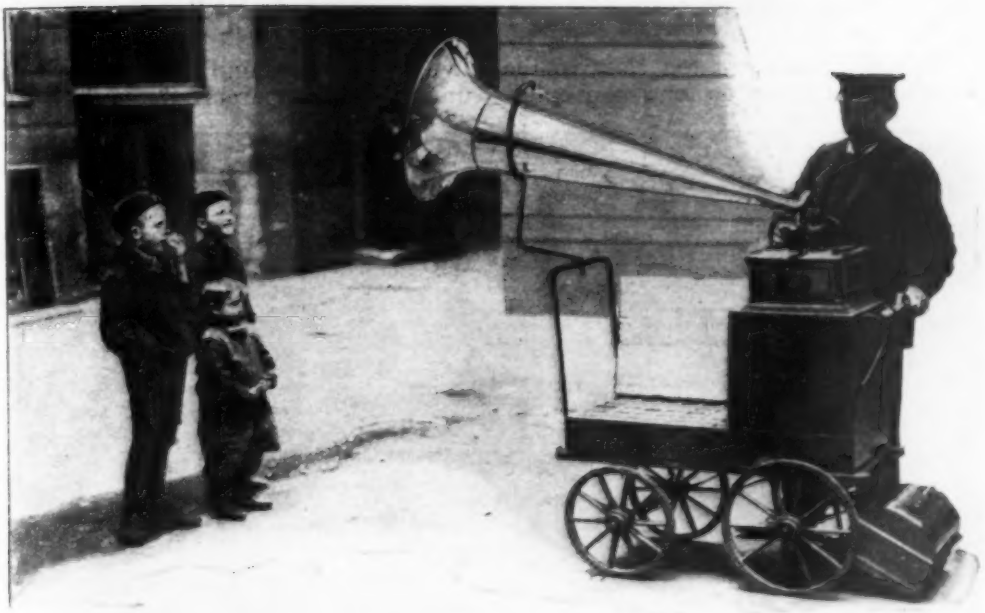
TRANSPORTING WATER BY CABLEWAY

During a dry spell, the spring which had furnished water for the limestone quarries at Split Rock, N. Y., became dry, and the problem of getting water for the boilers from some other source faced the company. For a time the famine was overcome by transporting water in 10,000-gal. tank cars, but the cost was $20 per car. In the meantime, a cableway, used to convey the crushed limestone to a soda factory three miles distant, was in active operation, and at last one of the officers suggested sending water back to Slip Rock in the limestone buckets.

The suggestion was acted upon, and the buckets, previously sent back empty, were overhauled for leaks and those in good condition painted white to designate them as watertight. The illustrations show the method of operation. In one of them a bucket is just



Emptying Water from a Bucket—Protecting Net Over Roadway



The Phonograph of the Street

being emptied of water, while another is traversing the line with a load of limestone. The other illustration gives a general view of the cableway, and shows a steel net suspended over a roadway to keep the stone from falling upon it from the buckets.

The buckets are filled and emptied without stopping the movement of the hauling cable in the following manner: At each end of the line the cable passes around a large pulley, and just before the buckets reach these pulleys a trip arrangement releases the bucket grips. At the same instant, a pointed switch lifts the buckets from the stationary suspension cable and transfers them to a side track, on which they are pushed to their destination. After being emptied at one end of the line and filled at the other, the buckets are pushed onto other side tracks and at the proper time the operators start them back onto the cableway again, the grips locking them securely to the hauling line.

In 1909 the patent office issued 33,514 patents, and 22,328 patents expired.

PHONOGRAPHIC STREET MUSIC

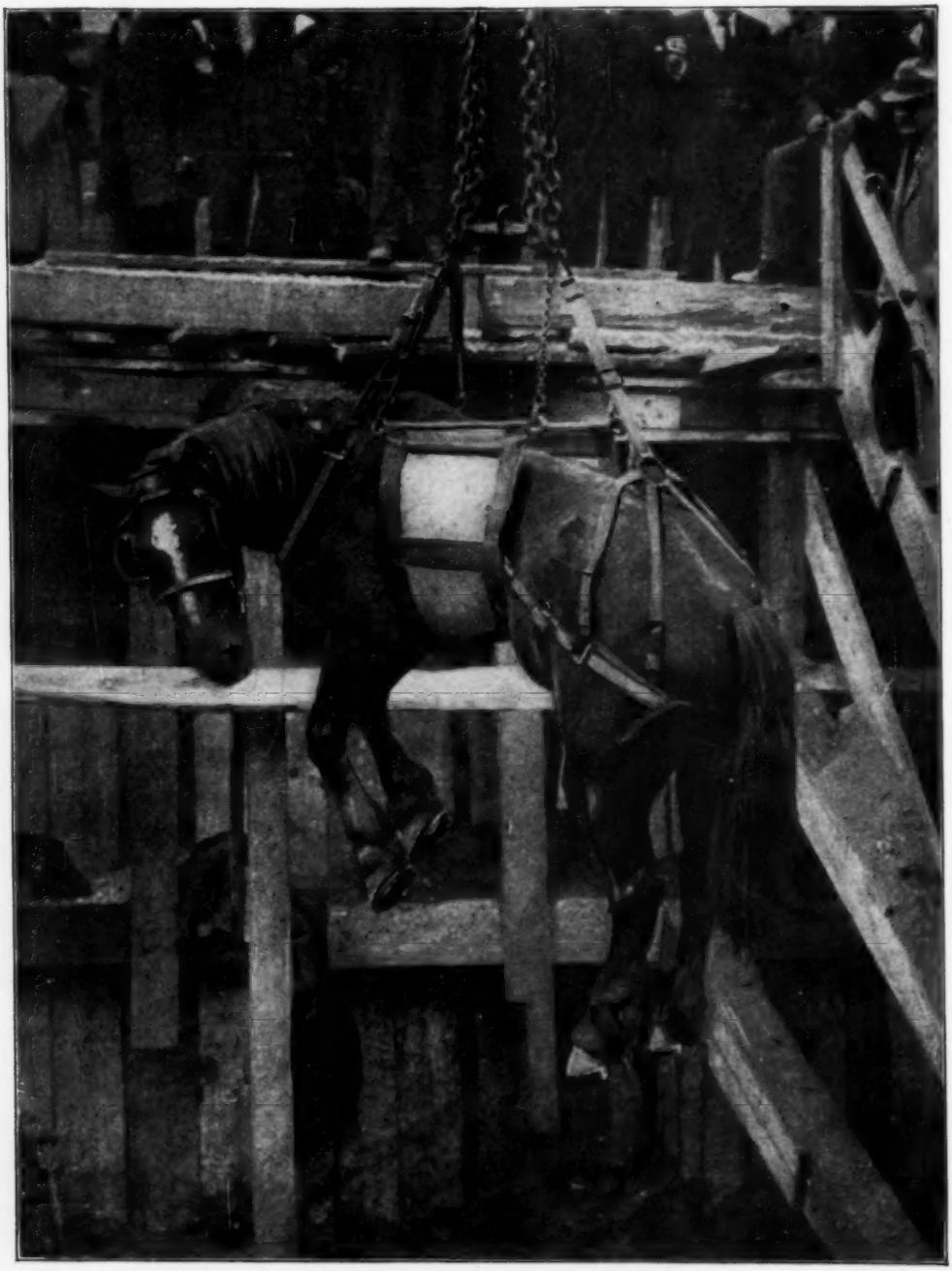
Many aspiring peddlers of street tunes in the cities of Europe are giving up the long-familiar Italian grind organ for the more up-to-date phonograph. The only drawback of the latter, from the peddler's point of view, is that the music does not carry as far as that of the grind organ, but from another point of view this is its greatest attraction.

The photograph was taken in Berlin, and clearly shows the method of mounting the horn, the position of the music box, and the manner in which the records are carried.

A table is being built for the Masonic library at Cedar Rapids, Ia., which is to contain about 30,000 different pieces of wood, most of them historic. One piece comes from the Charter Oak, another from the battleship Maine, another from the old fighting ship "Constitution," and there are pieces from the coffin of Jeff Davis, the home of Abraham Lincoln, and the old Kansas state house.

RESCUING A HORSE FROM A PIT

This old horse got too close to the edge of the excavation for a new building in Cleveland and fell in. He was unhurt and apparently contented to

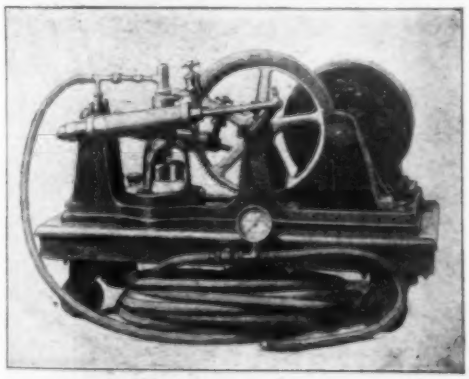


An Unusual Incident in Dobbin's Career

stay awhile. The contractor who owned him objected to his taking a vacation in the excavation, however. How to get him out was a problem, for the excavation was more than 20 ft. deep and so steep were the sides that the old horse could not climb out. Finally the contractor sent for a veterinary who brought a strong web belt. They fastened the belt about Dobbin's body, hooked it to the crane that was doing the lifting around the excavation, and Dobbin was hoisted out safe and sound. The camera man got him in mid-air.

ELECTRIC AIR PUMP FOR GARAGES

The task of keeping automobile tires inflated in a garage is made very simple by the electric air pump shown in this illustration. It is geared direct to a ½-hp. motor, and is mounted on a truck so that it can be wheeled from place to place. Electric connection is made by flexible wire to a convenient



Direct-Geared Electric Air Pump

lighting circuit socket, and several yards of air hose are provided.

THE MAKING OF FRENCH HEELS

The high heels worn by women, and known as "French" heels, are made from beech or birch wood. The manufacturers receive the wood in the bark, then cut it into blocks or bars and leave it in the air for a period of two years to be dried. The drying process

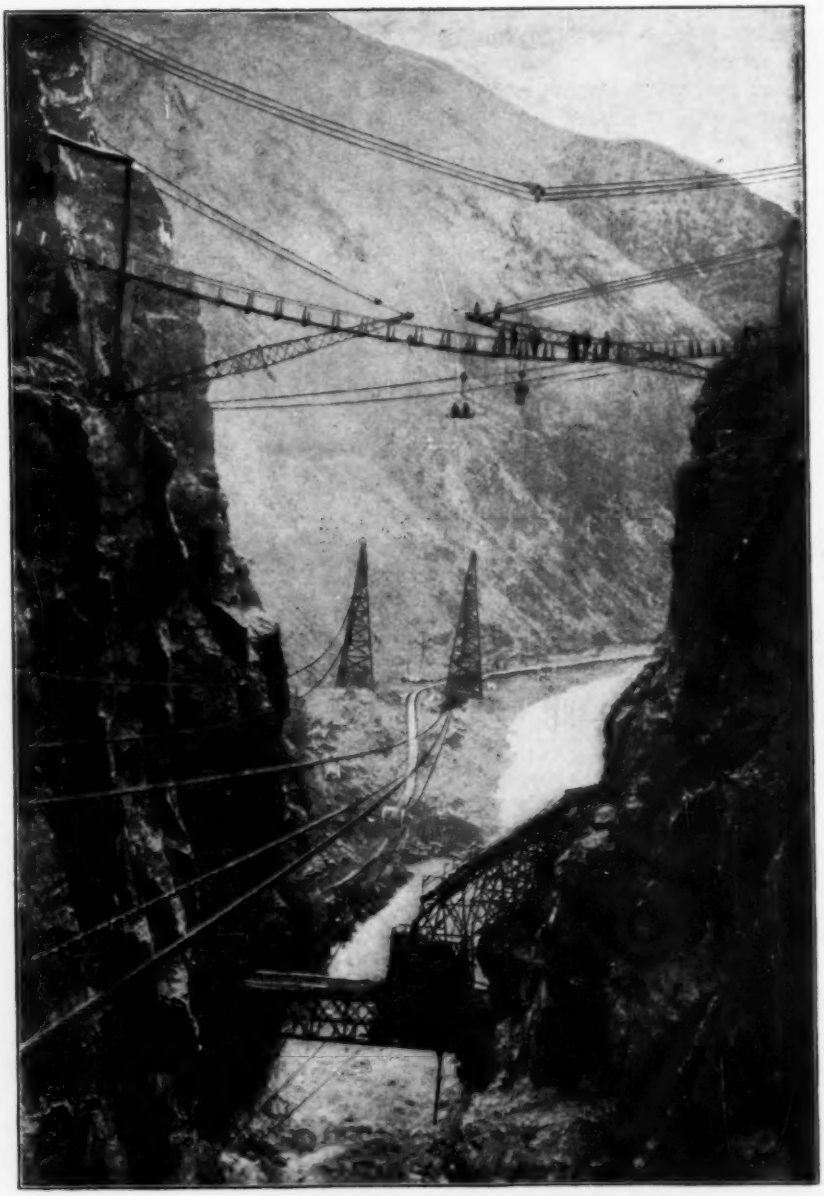
Cutting French Heels

is completed by a period of 30 days in a hot-air room, after which there is but little chance of cracking or exterior deformation.

The bars are then sawed into small blocks and gradually cut down by machinery into their final form. The illustration shows the intricate, yet simple-appearing machine by which this is done.

HARDEST WORKED OF AMERICAN RIVERS

The Blackstone river, although its drainage area is only about 458 square miles, is the hardest worked river in America, if not in the whole world. It produces 23,000 hp., or 50 hp. for every square mile it drains, and in its power-producing section it is only 43 miles long. Nearly a hundred mills receive their power from it. Catching the river's water in their whirling turbines at almost its very source in the city of Worcester, Mass., the mills line its banks, growing in size and importance, until in Woonsocket and Pawtucket, Rhode Island, some of the largest mills of the kind in this country are fed.



Courtesy N. J. Foundry and Machine Co.

Site of the Shoshone Dam

THE DAMMING OF THE SHOSHONE CANYON

The illustration shows the maze of mechanical appliances required in the construction of the great Shoshone river dam in the canyon eight miles southwest of Cody, Wyoming. The foot-bridge near the top of the photograph is 300 ft. above the river, and the mountains continue skyward in an almost vertical line for 1,000 ft. The dam will reach a height of 250 ft. above the river level, and extends to a depth of 80 ft. below the river bed to solid foundation.

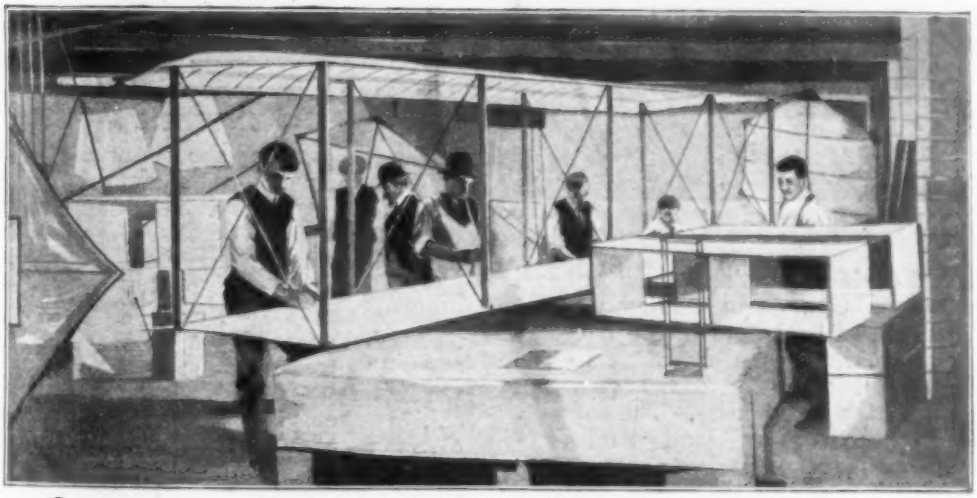
The photograph was taken looking upstream. The dam is under construction downstream from the steel bridge, which was built to carry the concrete mixing plant. The first work was the cleaning of the solid granite walls of the canyon of loose and seamy rock so that they could be used as abutments. This cleaning was done from a skip on a cableway crossing the canyon. Two cableways of 1,200-ft. spans were erected lengthwise in the canyon to carry away the rock blasted from the walls, and to remove the dirt and rock in excavating for the foundation. The two derricks, one on each canyon wall, handle the machinery used in the depths, and place the concrete on the dam, also.

While the dam is under construction the water from the reservoir will be drawn out through a tunnel 10 ft. wide, 10 ft. high, and 600 ft. long, which will pass around the right side of the dam, looking downstream. A flume, which winds between the two cableway towers, will direct the water into the tunnel. During high water, from June to September, the tunnel will not be capable of carrying all the water. Consequently, high pressure gates will be located in the tunnel to control the water in the reservoir.

The figures seen on the foot-bridge are Secretary of the Interior Garfield, Senator Mondell, of Wyoming, and several government engineers.

AUSTRALIAN AEROPLANE FACTORY

Although Australia is one of the youngest nations in the world it does not intend to be least in matters pertaining to aerial flight. The illustration shows its first aeroplane factory, which is located at Surrey Hills, a suburb of Sydney.



Australians Building Aeroplane

The Canadian government has called for bids for the removal of the wreckage of the Quebec bridge and for building the new structure.

CURIOUS PRECAUTION IN UGANDA

This drawing illustrates the careful and rather amusing precautions taken

Courtesy London Illus. News
Retiring Bachelors for the Night

by the elders of the Bekedi tribes in northern Uganda in dealing with the youths and bachelors of the tribe. All the unmarried men are made to sleep in small, specially constructed huts raised high up on posts. The entrances of the huts are so small that the occupants have to wriggle in on their stomachs, and access can only be gained by a ladder, which is carefully removed after the young men are safely disposed of for the night. Fine ashes are also strewn under the elevated huts so that if nocturnal excursions are made, footprints will tell the tale.

It is also of interest to note that the advent of clothes among the tribes of Uganda means less morals. The Baganda tribes, who have always been addicted to wearing apparel, are of notoriously lax habits, according to the governor of Uganda, while the majority of Bakedi, Kavirondo, and Nilotic tribes, who go about in a state of absolute nudity, are obsessed with a notable degree of morality.

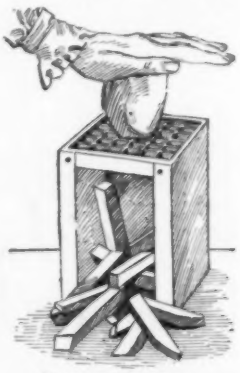
FIND AMBERGRIS FORTUNE

While out in a small boat in the Strait of Juan de Fuca, a few miles from Port Townsend, Wash., James Curry and a companion came across a floating substance, which was pronounced by chemists to be ambergris, with a value of close to $100,000. The find weighed a little more than 150 lb.

Ambergris is a substance derived from the intestines of the sperm whale, and is yellow or nearly white in color. It is very light, melts at a temperature of 140 deg., and is entirely dissipated on redhot coals. Its agreeable odor makes it very valuable in the manufacture of perfumes and its great value is due to its scarcity.

USEFUL HOUSEHOLD INVENTIONS

The illustrations show four different kinds of devices for the comfort of the household. One is a silent stair tread that cannot slip, is of low cost, and of great durability and attractive appearance. The treads are semi-elliptical, are held in position by metal strips, and are of white rubber, which can be replaced when worn. The metal strips and screws are of brass.



Potato-Chip Cutter

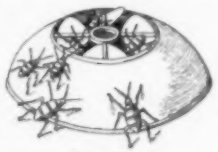
The beetle trap is an excellent device for the catching of any kind of bug that infests the home. The bait is

placed at the crest of its domed top and the approach to it is set with pitfalls through which the bugs fall.

The potato-chip cutter is an ingenious device that cuts as many chips at one stroke as the size of the potato makes possible. It is a box-like implement with a slotted top. The potato is forced down upon this top and drops to the bottom in the form of neatly cut chips of a regulation size.

Silent Stair Tread

The secret of a good cup of tea, a beverage drank to a greater extent in England than in any other European country, is the absence of the tannin which exists in the fibres of the leaves. The tea leaves, therefore should not be allowed to remain in the tea longer than four minutes, as the tannic acid becomes extracted after that time. The anti-tannic infuser shown in one of the illustrations is only one of many designed to make this possible. It consists of a vessel with perforated bottom, placed in an ordinary teacup, the top of the infuser fitting around the top of the cup. Hot water is poured into the cup until it rises almost to the top of the infuser, and then the tea leaves



Bug Trap

Courtesy Ironmonger's Chronicle, London

Anti-Tannic Infuser

are placed in the latter. After a period of three or four minutes have elapsed the infuser and tea leaves are removed.

HORSE-PROPELLED DELIVERY CART

This unique delivery vehicle, now familiar on the streets of Paris, is apparently composed of everything that goes to make up an automobile, with the exception of the motive power, and because of this exception the horse is added. The horse behind instead of in front is in reality an advertising scheme to draw attention to the wares the vehicle delivers.

Delivery Wagon in Paris

CHINESE JOSS USES BOX KITE FOR VENGEANCE

An immense box kite, used for advertising purposes, in Chicago, broke away from its lofty moorings recently, and came crashing down on top of a Chinese joss house while the devout Chinamen and their priests were in the midst of their solemn ceremonies. The kite was very heavy and when it struck the roof with a thundering crash its metal frame crossed several heavily charged electric wires, causing a great spluttering and flying of sparks.

The suppliant throng below, with bowed heads, were intoning, and waiting for a demonstration of supernatural power. It came. The terrified Chinese rushed pell mell into the street to escape what they thought was the vengeance of their joss.

Having apples labeled by nature with the name of the restaurant is a novelty in New York. It is accomplished by pasting a paper letter stencil on the fruit when green. When the apples have ripened the letters appear in green on the red background.

A MIXTURE OF ASIA AND EUROPE

A curious combination of Asiatic mannerism in a European setting has

Modern Train in Japan

been developed by the advent of modern railroads in Japan. In the modern English railroad coaches adopted by the Japanese lines the travelers sit cross-legged on the upholstered seats, their curious wooden sandals placed on the floor in front of them.

THE JUMPING-BEAN GAME

"Beano," the new game with which the English people are amusing themselves in leisure time, owes its popularity to the fact that the result cannot be determined in advance, and winning is simply luck. Because of this feature, it has become the only really interesting parlor racing game, and many players bet upon the result as they would bet on a horse race.

It is a simple game, played with a number of jumping beans, and a warm plate, and its conception was due to a desire on the part of Mr. Cyril Maude, president of the London actors' orphanage, to provide a means of benefiting the fund of that association. It was hoped that all who played and enjoyed it would send 25 cents to the fund.

Mr. Maude describes the game as follows: "Take a large warm plate; draw a series of circles on it like those of a target and deal out to each player a jumping bean previously marked with a distinguishing daub of color. Then place all the beans in the center circle. The first bean that jumps its way outside the outermost circle takes the pool."

The jumping bean, or "Carpocapsa Saltitans," is the product of a tree recently discovered in a morass, half a mile square, near Alamos, Mexico. The fruit, as it grows upon the tree, is of triangular shape, divided into three equal portions. Two of the parts contain a small spherical black seed, while the third compartment contains the jumper, which is a small worm with 16 feet. When the fruit is ripe it drops to the ground and splits, and that part containing the jumper immediately starts off, jumping in an extraordinary manner away from the tree on which it grows. The beans ripen in July and

Courtesy London Illus. News

How the Game Is Played

August, and go on jumping until the following May.

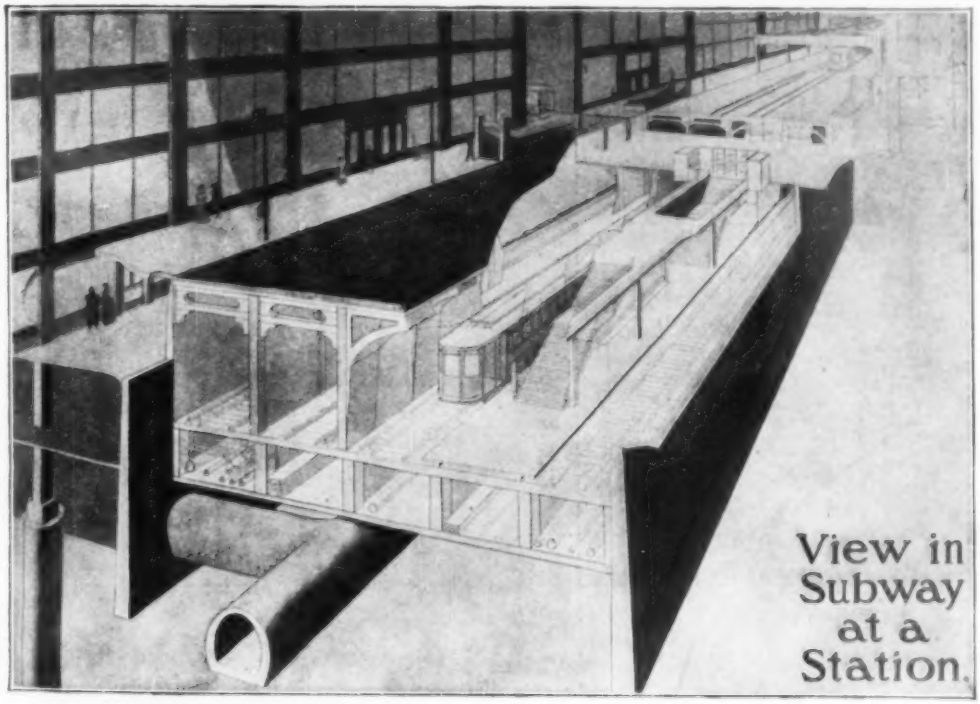
REMARKABLE SUBWAY PROJECT

Underground Tunnels for Traction Cars, Supplementary Sidewalks and Public Utilities Planned by Chicago Engineers

By DAVID HARRISON STEVENS

A model subway that will not only relieve the street congestion by freeing it of surface cars, but will also have underground sidewalks and commodious tunnels for the accommodation of the pipe lines and conduits of the public utilities is the plan evolved by the city engineer of Chicago as a solution of the traffic and traction problem with which that city is struggling.

If the plans are accepted by the city government, to which they will be submitted shortly, Chicago will have one of the most comprehensive systems of subterranean thoroughfares in the world The remarkable system of tunnels and subways which underlies the North and East rivers of New York and which bore under the eastern metropolis will continue to be the most spectacular accomplishment, but the engineers who have thought out the solution of Chicago's traffic difficulties declare that their scheme will be more effective as regards the peculiar conditions in the Windy City.

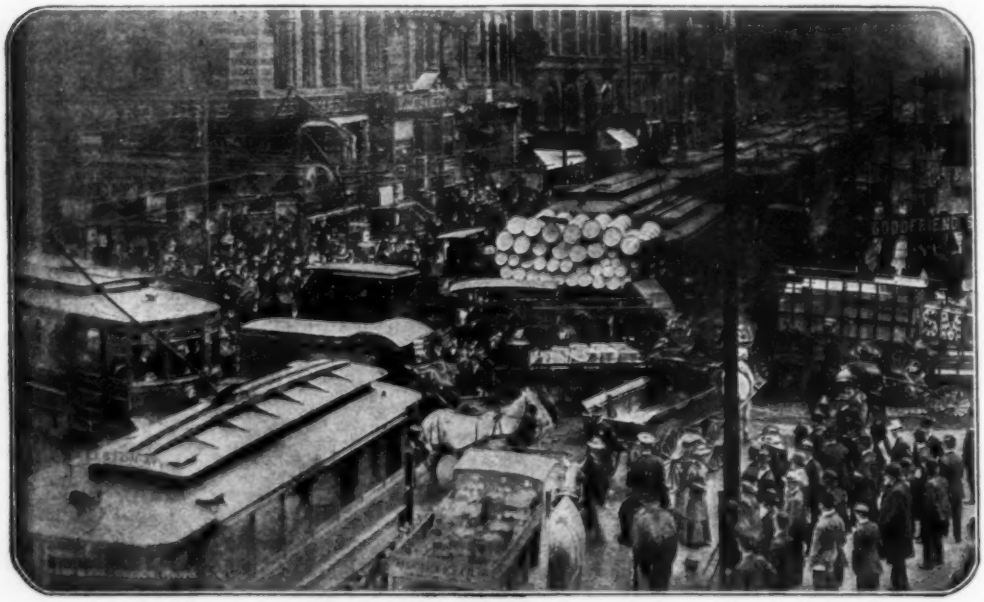


Cross Section of Traction Subway, Public Utility Tunnels and Freight Tunnel

And what is more than all this, and what would be more wonderful than the engineering feat involved, is the civic betterment which they believe would follow the relief of traffic conditions, and the beautifying of the city.

It will take many years and something like $112,000,000 before it is complete in every detail. In the main, it will include subways under the business district, with terminal stations located where the four elevated railway lines now enter the district. All surface cars from their respective quarters of the city will also converge at these stations, and elevated and surface cars alike will shoot downwards beneath the surface and become subway cars until they again pass out of the district. Under Wabash avenue, one of the principal thoroughfares, will be a 4-track route, running from Chicago avenue at the north to 22nd street at the south, a distance of about 3 miles, for the passage of all through cars from the south and north sides of the city. The loop, which now confines Chicago's main business center within an area of less than a square mile, will be a thing of the past, while the streets of several square miles of business district will be practically free of tracks, and the central portion completely so. From the west side of the city two subway tubes will run in beneath Randolph and Washington streets, returning under Adams street and Jackson boulevard.

It is estimated that the first stage of the project will cost $40,000,000, and that its capacity will be 50 per cent more than all the traction lines now operating within the district. This will serve the needs of the city for a few years, then another expenditure of $40,000,000, and a few years later still another of close to $40,000,000 more, and Chicago's growing population could comfortably be taken care of as far ahead as 1950. Every busy street within the subway zone, which, of course, would be extended, will cover a branch of the system, if the plans are carried out.



Congestion in Chicago's Business District

Recent investigations have shown that the ground under the down-town streets is interlaced with a chaotic mass of pipe lines and conduits. All the public service companies have run their conduits to suit their own convenience, until, at certain points, further expansion is impossible. Therefore, subways must be provided for these lines as well as for the millions of gallons of water that must be pumped into the business district daily. These are provided for

as shown in the subway illustration. Close under the surface of the street are the four lines of railway for the traction systems, and underneath these are five chambers, provided for the water and gas mains, and the other pipe lines that now lie under the street surface. Sufficient space will be allotted for the future needs of the city's water supply and for the needs of each of the public utility companies. Entrances will be provided at short intervals, so that inspection and repair of the pipes can be easily made. The tearing up of streets will then be an inconvenience of the past. The cost of this feature of the subway scheme is included in the $112,000,000 estimate.

The tube beneath the five chambers is a section of the Illinois freight tunnels, which now thread their way under many of Chicago's streets.

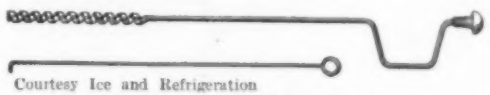
How soon this stupendous subway project will be built is problematical, but if kept free from the tangle of political delay, an early beginning of the work may be expected, although the final completion will probably mean a matter of many years. But the first $40,000,000 expenditure will mean comparatively clear streets for the business district for several years, a condition now imperative, if the city would progress.

One of the illustrations, which is a photograph taken in May, 1909, at Dearborn and Randolph streets, shows the present congested condition of Chicago's business district. Rapid movement of street cars has become impossible, and an increase in the number of cars means still more congestion. The tangle of cars, trucks, and other vehicles is now such that the cars crawl at a snail's pace, waiting at every corner for other cars and vehicles to cross. A broken wagon wheel stops progress until the cars are lined up for blocks in every direction. At State and Washington streets, one of the most congested corners, as many as 1,000 street cars and vehicles pass during every hour of daylight.

Where tunnels cross each other, one will dip in its course, so as to completely pass underneath the other, thus eliminating the danger of underground collisions.

MEASURING THICKNESS OF ICE

The ice upon rivers where currents exist may appear very favorable for cutting, but the current may have cut the ice underneath in such a manner



Courtesy Ice and Refrigeration

Ice Auger and Measuring-Iron

as to make cutting unprofitable. Frequent inspection of such an ice field is therefore imperative, and this can be easily accomplished by means of the auger and measuring-iron here illustrated. The measuring iron has a hook at the lower end which will clutch the under side of the ice when drawn up through the auger hole against it. The inches marked on the iron will give the thickness.

PEARY VICTOR IN THE POLAR CONTROVERSY

"The documents handed the university for examination do not contain observations and information which can be regarded as proof that Dr. Cook reached the North Pole on his recent expedition."

This was the finding of the committee of scientists who examined the data furnished by Dr. Frederick A. Cook as evidence of the discovery which he claimed.

Just a week before this decision was announced to the world Commander Robert E. Peary had been officially recognized as the discoverer of the Pole, when at a banquet given in his honor in Washington, he was presented with a gold medal by the National Geographic Society. Commander Peary had submitted his proofs to this society some weeks before.

The finding of the Danish scientists was made public on December 21st. Cook's friends fell away from him with this, but a few who remained loyal pointed to the fact that the scientists had not declared that the explorer had not reached the Pole, but merely that the data submitted had not proved it.

Dr. Cook had disappeared about a month before this finding and his whereabouts was a mystery. After the committee had spoken, however, the press and public vied with each other in condemning him.

TYPE OF AERONAUTICAL ENGINES UNSETTLED

The exhibition of airships held at Paris made it very plain that engineers have not progressed beyond the experimental stage in aeronautical engines. While the exhibition at the Grand Palais brought out more engines designed for use on aeroplanes than were ever gathered together before, it is also true that their diversity in design equalled their number, proving that almost everyone who attempts to build an engine for this purpose has different ideas on the subject. It is generally admitted that it is desirable to employ a reliable air-cooled engine for aeroplanes, yet three-quarters of the exhibitors showed engines with water jackets. All types of engines are now being employed, more or less successfully, on flying-machines,—water-cooled, air-cooled, vertical, V-shaped, horizontal and rotary. It will be a survival of the fittest.

Writing by Wireless

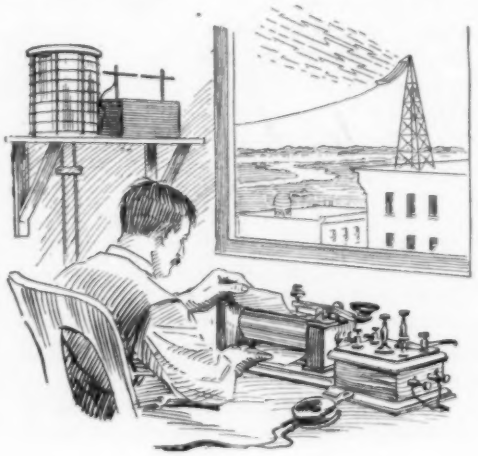
Inventor Claims Discovery to Transmit Signatures Through Air

By Thomas W. Bibb

The transmission of signatures, or other writing, by wireless waves has occupied my attention for some time, and although better results must be obtained, and the crude instruments improved before the device will be of commercial value, I have been able to transmit several readable signatures.

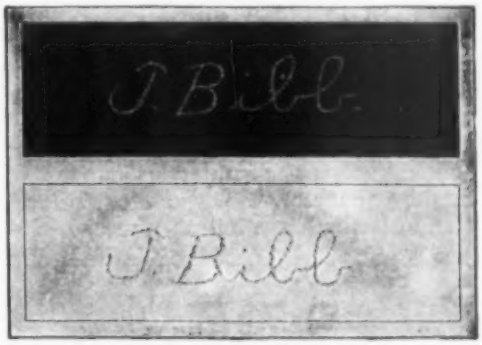
At first, experiments were made in which movable arms were controlled by variations of the strength of the waves, in a manner similar to the wire telautograph, but the idea was given up as impractical after varied attempts. Then my attention was given to experimenting along the line of my present apparatus, which will be perfected.

The transmitter consists of a revolving cylinder which travels in the direction of its length about one-fiftieth of an inch each revolution, controlled by convenient mechanism to cause it to revolve at a low rate of speed. Over this cylinder fits a light tin plate which is covered with a thin coat of wax. The signature is written upon this wax-covered plate with a sharp metallic pencil. The plate is one side of a circuit through a relay. The other side of the



circuit is a metallic needle which rests upon the cylinder in such a manner that the circuit through the relay is completed when the needle comes in contact with the metallic plate. When the cylinder is revolved the needle comes in contact with the metallic plate at the points where the wax has been scratched off the plate, and at that moment a short electric wave is sent out from the induction coil in circuit with the relay. At the next revolution the cylinder has moved over one-fiftieth of an inch and the process goes on.

At the receiving station is a cylinder of the same size and moving at the same rate. When the wave strikes the coherer the relay circuit controls an arm which makes a dot on the paper on the cylinder. This has been accomplished in my receiver by a telegraph instrument, which hits the cylinder every time a contact is made in the sending station, and makes the dot through a piece of carbon paper.



Photographs of Writing on Wax-Coated Cylinder Transmitter and Receiving Cylinder.

The dots are close enough together to represent lines when they are made in the order of the contacts made at the transmitting station.

STOVAINE—THE NEW ANESTHETIC

To dispel the scepticism of many of the American surgeons regarding the use of stovaine, the new anesthetic, Dr. Thomas Jonnesco, of Bucharest, Roumania, has made demonstrations of its efficacy in several hospitals in this country.

This new anesthetic permits the person operated on to retain consciousness, and Dr. Jonnesco claims it is more free from harmful after-effects than the anesthetics now in general use.

At a demonstration at the County Hospital, Chicago, on Dec. 21, three operations were performed with its aid, before a body of noted surgeons. While all were very successful, a few surgeons still maintained that it was inefficient for general use.

Stovaine is used alone when operations are to be performed on the lower part of the body, but when it is intended to affect the part of the body above the waist line strychnine is combined with it. The anesthetic alone would paralyze the heart.

It is pronounced sto-va-ine.

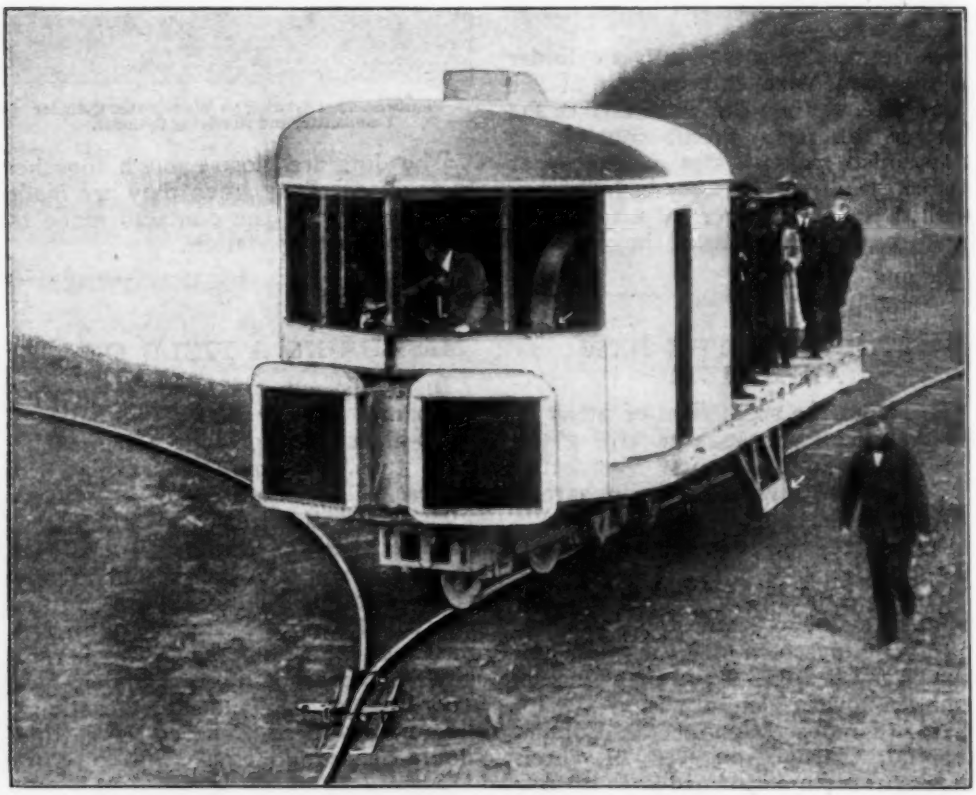
MEASURING A FIELD OF ICE

In laying out a field of ice, the ice companies usually figure that an acre of 12-in. ice will provide a harvest of 1,000 tons, but more ice than is expected will be required to fill the ice-house must be prepared for cutting, because of the possibility of waste or of loss by a spell of comparatively warm weather. Should the ice be thinner than 12 in., the surface, naturally, must be extended, and if thicker, it may be correspondingly smaller, but, according to "Ice and Refrigeration," the amount of ice prepared for cutting should be as follows:

"Should 30 acres be required to fill the house, not less than 40 acres should be scraped free of the first snow. The requisite acreage of the field, however, may be of any rectangular shape providing the necessary surface is covered. An acre equals 43,500 sq. ft., and following are given the dimensions of different shaped surfaces equal to an acre when multiplied: 60 ft. by 720 ft., 66 ft. by 660 ft., 110 ft. by 397 ft., 130 ft. by 363 ft., 220 ft. by 198 ft., 240 ft. by 180 ft., 440 ft. by 99 ft."

THE SUCCESS OF THE MONORAIL

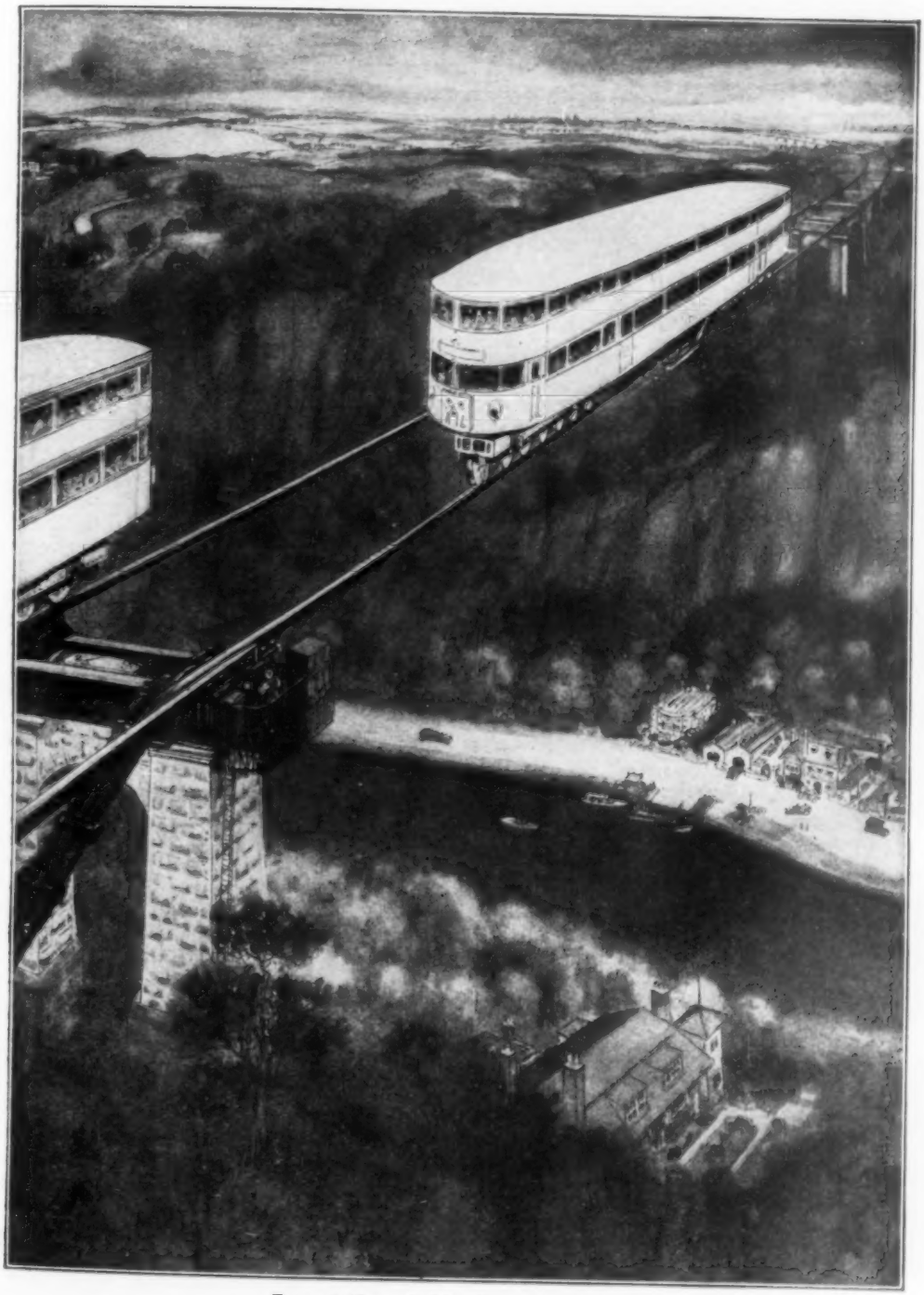
An article in the January issue drew attention to the wonderful success of the tests of a full-sized monorail car near London in November, but the idea is so revolutionary in railroad transportation and the possibilities of its adoption in the near future are so probable that the subject is worthy of further space. Also, the illustrations, some of which are actual photographs, now available will give the reader a far better idea of just what the car is like than would a word picture alone.



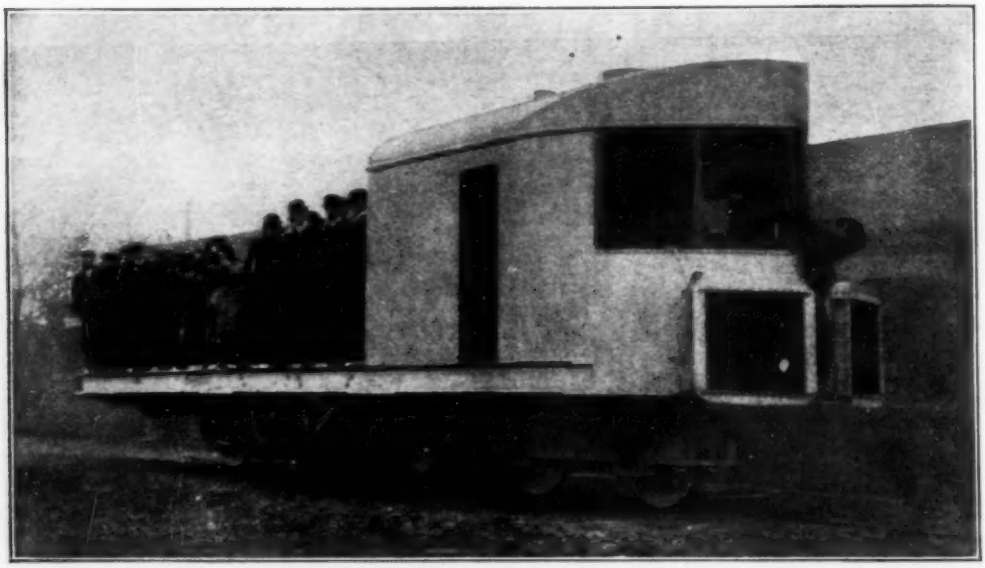
Monorail Car at a Switch

The possibilities in the system lie, of course, in the gyroscopes. Two of these are mounted side by side, but some few feet apart, in the cab of the car, and their purpose is to correct the tendency of the vehicle to depart from a position of stable equilibrium. The wheel of each gyroscope weighs 1,500 lb., and each is driven at a speed of 3,000 revolutions per minute by an electric motor. Each wheel and its motor are contained in an airtight casing, and they run in what is nearly a vacuum.

Both gyroscopes are arranged with their axes horizontal, and, normally, at right angles to the rail. When there is a tendency for the car to lean either to one side or the other, this is corrected automatically by mechanism actuated by pneumatic power, which alters the planes of rotation of the gyroscopes, deflecting them either to the left or the right in the vertical plane, as the case may be. Consequently, when the car begins to lean to the right, the planes of rotation of the



Type of Monorail Line That May Evolve



Car at Standstill—Forty Passengers on One Side

gyroscopes swing just the same distance to the left, and the rapidly revolving wheels bring the car back to its vertical position, or, to be more clear, are continually fighting to keep it from getting out of that position. Just how well they succeed may be gained from the fact that the 40 persons who rode on the car during its

The Possibility of Billiards

tests were at times placed along one side of the platform, yet the gyroscopes equalized this over-balancing tendency, even though rounding very severe curves.

The tests of the car were made on a track 1,980 ft. long, 440 ft. of which was laid in a circle, while the remaining 1,320 ft. was a straight stretch. The wheels of the car, as is clearly shown in one of the illustrations, are four, mounted two and two in two independent tandem trucks. When on a straight track all the wheels are, of course, running in a straight line, but, as the center pins of the trucks are connected to the body of the vehicle by means of ball bearings, there is considerable flexibility in rounding curves. So much, in fact, that reverse curves of 35-ft. radius were readily negotiated.

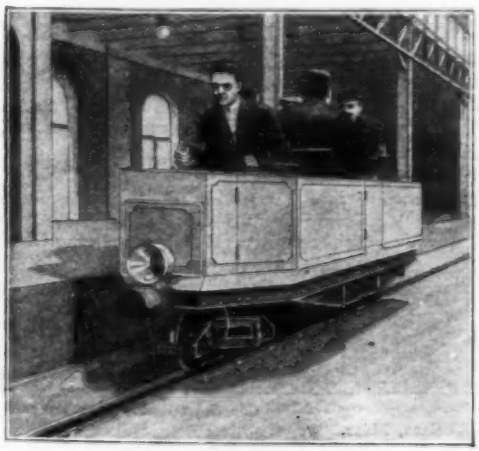
The car used in the tests consists of a platform 10 ft. wide and 40 ft. long, at one end of which is a cab containing the propelling and controlling mechanism. The propelling machinery consists of two gasoline engines of practically the same type as an automobile engine, one being rated at 80 hp. and the other at 20 hp. Each engine directly drives an electric generator, which supplies current for driving the motors, for revolving the wheels of the gyroscope, for developing the pneumatic power which alters the planes of the gyroscopes, and for working a small

motor that drives an oil pump. The two gasoline engines can be used separately or together, consequently, the power applied can be varied from 20 to 100 hp. With only the 20-hp. engine working the car will run at a speed of 7 miles an hour, while both engines will drive it at a speed of about 35 miles an hour.

The illustration showing the crowd on the platform was taken while the car was in motion, while the one showing the front of the car with the inventor standing before it was taken while the gyroscopes were working and the car standing still on its line. The other illustrations show a small monorail car being tested out by Herr Scherl, a German rival of Mr. Brennan; an idea produced by the London Sphere of a future monorail line, and the Illustrated London News' conception of a game of billiards on a monorail train.

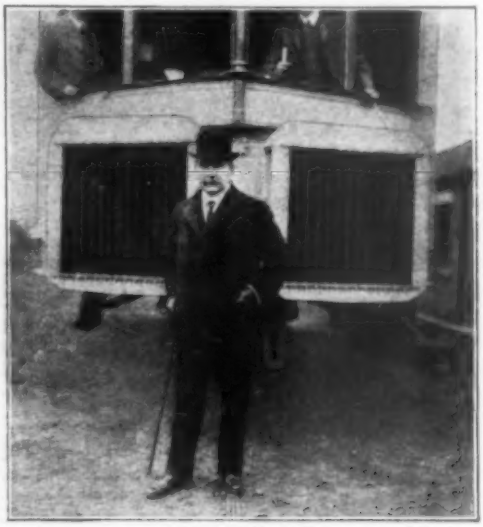
The German monorail car is not much further advanced than was Mr. Brennan's model of a couple of years ago. It will hold but four persons, and is claimed in England to be a palpable imitation of the English inventor's conception. It is said that Herr Scherl is to bring his car to America for exploitation.

The illustration of the imaginary



The German Monorail Car

monorail line would naturally give the beholder a fearsome idea of such a means of transportation, but in reality such a kind of bridge would be practically as safe for the gyroscope car as any other. The double flanges of the wheels would keep them on the cable, and the car, of course, would keep itself erect as easily as on a single rail laid on the ground.



Front of the Car and Brennan

Whether or not a game of billiards would be possible as illustrated is a question. The presumption is that the gyroscopes would keep that car at just the exact dip in rounding a curve to offset, by centrifugal force acting on the balls and tending to throw them towards the outside of the curve, the tendency of the balls to roll towards the lower side of the table.

LARGEST GAS RESERVOIR EXPLODES

A leak in a new gasometer caused the explosion of what was said to be the largest gas reservoir in the world, at Hamburg, Germany. Twenty-seven persons were killed. The reservoir had a capacity of 7,000,000 cu. ft., 350,000 cu. ft. of gas had been admitted for the purpose of testing it, when escaping gas penetrated the retort house and was ignited. The explosion followed, and shook the entire city.

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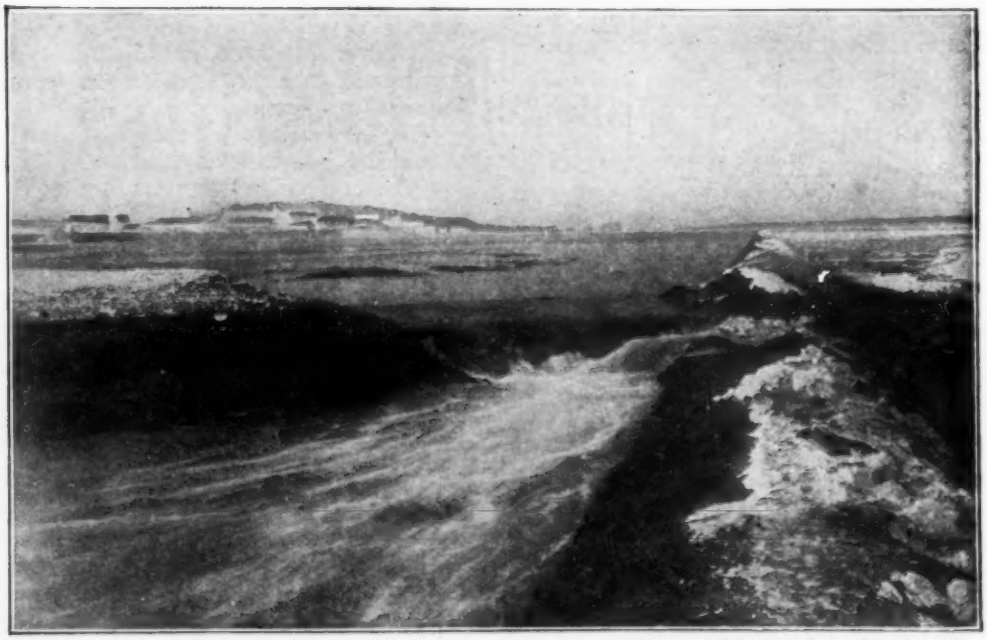
Wreckage of Cottages at Winthrop, Mass.



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Break in Dike at Chelsea, Mass.

TIDAL WAVE STRIKES NEW ENGLAND COAST—A tidal wave which was kicked up by a storm on the Atlantic and was felt along the whole New England coast, came as an unwelcome Christmas present to Chelsea, Mass., Winthrop, and other places near Boston. The giant wave broke down the dike used to protect the lower part of the city in Chelsea and 1,500 were made homeless by the destruction of property. Winthrop is a summer resort and the wave destroyed many cottages there.

MECHANICAL AND SCIENTIFIC PROGRESS OF 1909

The contribution to the long serial story of progress of the year which has just closed has been a notable one. In the laboratories of the chemist and the physicist as well as in the workshop the brains of men have been at work as never before seeking the solution of new problems and making their way slowly into realms of science which promise to bring additional earthly elements under human control.

In all parts of the world thousands of men have been attacking the dark places, and throwing more light into the regions of knowledge already opened up by the pioneers of science. In the more spectacular fields, such as the development of aerial flight, the transmission of messages through air waves, the overcoming of distance by the development of speed in steamships, railroad locomotives and automobiles, the improvement of warships and weapons of warfare, the strides made during the year 1909 have been astounding.

But above all other things the year will be remembered because it was in 1909 that the world was startled by the news that the North Pole had been discovered.

Probably in no other branch of science has there been such an advance as in the art of flying. The events of the past twelve months have demonstrated that man has mastered the air and that the complete subjugation of that element as a mode of transportation is merely a matter of continued development. A few years ago, man-flight was linked with the memory of Darius Green, but when the year 1909 closed airships were being constructed in all parts of the world and a score of men had achieved fame as aviators. Records for speed, distance, and height were made and broken with a swiftness that amazed the world. Blériot, a Frenchman, crossed the British channel in his monoplane, and the world awaits with confidence the man who will fly across the broad ocean. Hubert Latham, another Frenchman, but a short time ago smashed the height record, up to then, held by Orville Wright, when he ascended 1,800 ft. above the earth in an aeroplane. Fifty miles an hour became common, and man ceased to wonder when the machines flew 100 miles. In a dirigible Count Zeppelin covered 860 miles in 37 hours, and on another flight he ascended over a mile.

In communication by the transmission of messages through the air there has been a correspondingly great advance, for not only have wireless telegraph messages been sent a distance of 3,628 miles, but the transmission of the voice through the air has become a reality. The wireless record was made by the "Minnesota" of the Great Northern Line on the Pacific, which kept in constant touch with Seattle and Yokohama during the trip across the ocean. Yet before this number of Popular Mechanics appears on the news stands this record and many others may have gone a-glimmering. Experts are working indefatigably in an effort to utilize the earth itself as a means of transmitting messages. Nicola Tesla, at his Long Island Laboratory, and other experts, under the direction of the French government, are seeking to discover the means by which this may be done. And a California man, in this issue of this magazine, claims to have perfected a means by which actual writing may be transmitted without the use of wires.

Record breaking ships are being launched with such frequency that it seems almost futile to chronicle them. But a few weeks ago there was launched at a Camden, N. J., yard the battleship "Utah," which it is claimed will be "the largest and most formidable" of all sea fighters. This year also, the first funnelless warship was launched, the British cruiser "Indefatigable."

From Washington recently came the news of the success of the huge 14-in. gun, and the noiseless gun of Hiram Maxim has been followed by the adaptation of his silencer to cannon. England is now experimenting with a rifle fitted with electrically lighted sights for use at night, and the application of the telescope for sighting rifles at long range has been improved. Worthy of mention, too, is the amphibious automobile, just adopted by the French army, which travels on land or through the water.

Motorboat records have gone by the board, and automobile records established. Although the high-speed record of 127.87 miles an hour for an automobile, made by Hemery, on the Brooklands track in England, in 1908, still stands, records for road racing have been broken on all sides.

The monorail has made great steps forward during the year, successful experiments having been made in public by Brennan, the English inventor, and by a German inventor working along similar lines.

Many improvements have been made in the new art of color photography. "No new achievements mark the year," says Wilfred A. French, an authority on things photographic, "but the kinemacolor, invented by G. Albert Smith of London, a system of motion picture projection in colors, has been perfected." It was shown in the United States for the first time at New York on December 11.

As to the means of producing light, but one new form has made its appearance during the year, according to the Illuminating Engineer. This is known as the titanium carbide arc, and the novelty in this case is one of detail rather than of principle. It is, as the name indicates, an arc lamp in which the electrodes, instead of being pure carbon as in the case of the older arc lamps, or carbon mixed with chemical salts as in the case of the "flaming arc," are of titanium carbide, a chemical substance produced in the electric furnace. It is claimed to have advantage in efficiency and longer burning on one trim.

A few months ago the country was much interested in an experiment tried in Cincinnati, when an entire baseball diamond was illuminated, and the great national game played at night. This augurs well for what may be done in the future.

Working away without ostentation and with little of the publicity given the more spectacular achievements, the physicists and chemists have accomplished much. In March Sir William Ramsay announced that he had succeeded in transmuting four different substances into carbon—zirconium, thorium, hydrofluoric acid and bismuth. Just a month prior to this Dr. E. S. Bailey of New Orleans announced that he had perfected a substitute for radium, "radio-thor," a substance made of pitchblende. A Roumanian physician during the year made successful demonstrations throughout the country of the new anesthetic which he discovered and called stovaine. It paralyzes the nerves of the body without robbing the patient of consciousness, and is claimed to be free from the baneful after-effects of ether and chloroform.

Through accident a Denver jeweler discovered a means of hardening copper, a long lost secret, and a Frenchman has successfully manufactured sapphires that defy experts.

This is by no means a complete list of what has been done, for such a list would take a volume to describe. Toward the accomplishment of the great tasks that man has set out for himself, including the harnessing of the heat of the sun to produce power, the utilization of the power of radioactive substances, the discovery of what our neighbors the Martians are doing, and many other lines of inquiry, physicists are working day and night, and brave indeed would be he who would attempt to prophesy what the year 1910 will bring forth.

At Gate of Servian Garrison at Belgrade

SENTRY BOXES OF EUROPEAN ARMIES

"What a peculiar barber pole," remarked an American tourist, as he paused in the cosmopolitan city of Monte Carlo, and gazed with a puzzled look at a box-like little house near the outskirts of that famous resort.

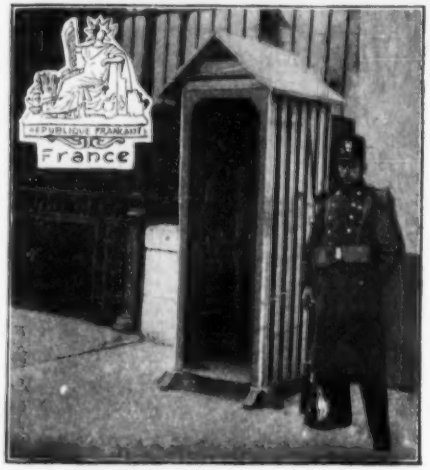
The guide was astonished, and looked the part. "My dear sir," he said, "that is no barber pole—that is one of our sentry boxes." He felt that the principality of Monaco had been insulted.

That tourist might have made the same mistake in six or seven countries of Europe, for at many points along the streets or highways are these sentry boxes at which a guard is stationed, strangely decorated little houses, painted much in the same manner as the poles which indicate a tonsorial establishment.

A Guard Before Castle at Copenhagen

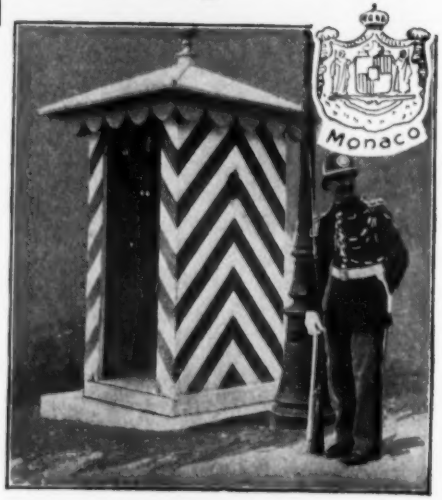
Broad stripes of coloring serve to make them conspicuous, and undoubtedly this is the reason for the decorative scheme. This same idea still prevails in the decoration of toll gates in many parts of Europe so that the traveler may not pass by without paying his toll to the gatekeeper.

The characteristics of the art of the different countries of the Continent are often expressed in the manner in which the sentry boxes are made and painted. While in England the box is as simple as possible and devoid of ornamental features, some of those which may be seen in Italy and Greece are splendid specimens of architecture and are constructed of marble and other stone.



Those used by cavalrymen stationed at guard points in some of the German cities are more like houses than boxes. They serve the original purpose of sentry boxes, however, and that is to protect the soldier on guard from unnecessary exposure to the elements, and at the same time have a large open door to allow him to jump out at a second's notice.

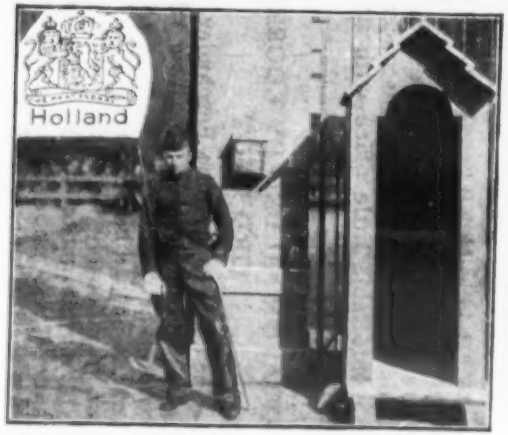
Many of them are very picturesque and invariably the tourist army makes them the object of attack with the omnipresent kodak. The photographs here presented are the result of a pains-



Russia

Germany

Greece


Holland

Switzerland

Italy

German Cavalryman's Shelter

taking collection of the most distinctive types now in use in Europe.

One may encounter them at the most unexpected places, but they are always to be found at the entrance to forts and garrisons. In the height of a raging snow storm a Russian soldier may be seen, covered with his long, winter coat, on guard near a broadly striped, little guard house, and in the tiny kingdom of Servia on the Danube, the box is just as much of a military institution. They are not in such general use in the United States for more often at the entrance to garrisons, forts and navy yards, the guard is cozily ensconced in a comfortable little office with many windows.

AVIATOR KILLED BY LOOSELY TIED KNOT

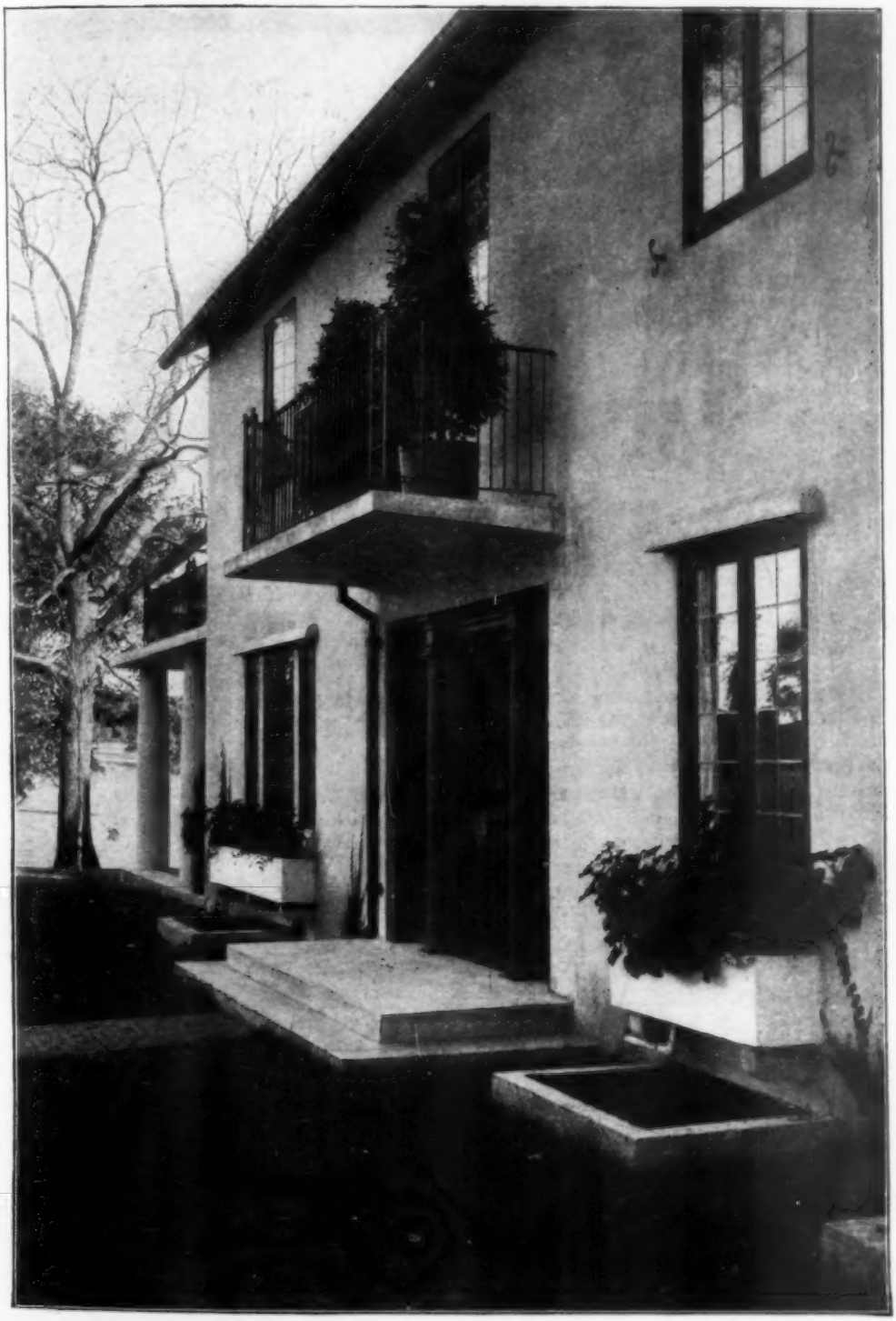
The death of Antonio Fernandez, the Spanish tailor-aviator, who was killed when his aeroplane got beyond his control and dashed him to the ground, was due to a loosely tied knot, according to late information from Paris. Fernandez had renounced the tailoring trade for the more uplifting profession of aviation but a few weeks before his fatal flight, and constructed his own machine.

He used a cord instead of a lever for the operation of his steering planes. This broke just before he made the flight, and he united the broken ends by tying a knot. Had he been able to tie a good knot he might not have been killed.

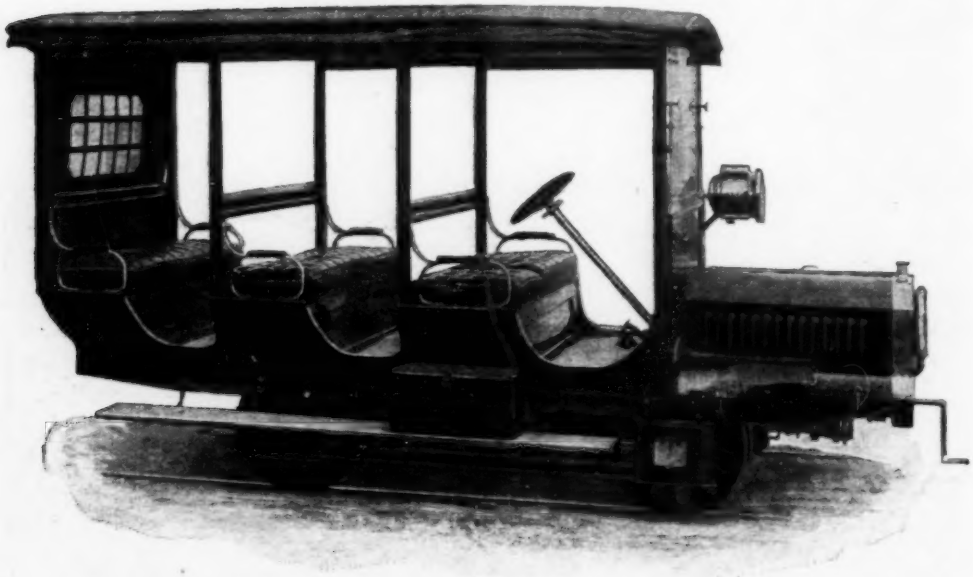
The accident happened at the new aerodrome near the mouth of the Var river in France on Dec. 6. He had gone about 200 yd. and ascended to a height of over 1,000 ft. when the knotted cord parted and he lost control of the machine. Fernandez was the fourth man to be killed in motor-propelled flying-machines.

M. Bleriot, the French aeroplanist who made the flight across the English channel, had a narrow escape from death on Dec. 12 at Constantinople. He was making an exhibition flight in a high wind before an immense crowd. His machine ran into a house, turned over, and tumbled to the ground. Bleriot was seriously injured.

The laundry operated solely for the royal household of England is said to cost $275,000 a year in maintenance.



ARTISTIC CONCRETE BUILDINGS—No. 4, Residence of Alexander Cochrane, East View, N. Y.

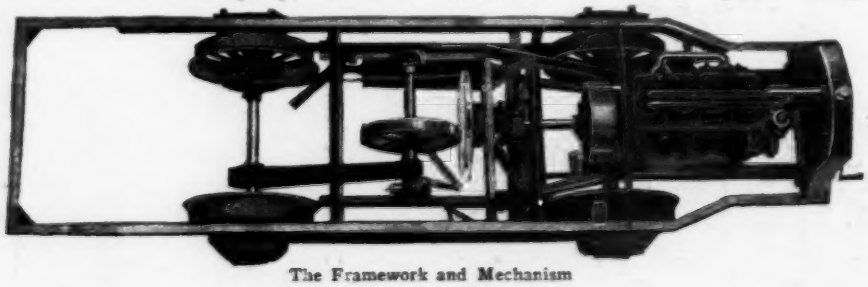


Harriman's Auto Railroad Car

SPECIAL AUTO-RAILROAD CAR FOR HARRIMAN SYSTEM

Just before his death, Edward H. Harriman ordered the auto-railroad car shown in this illustration for use on the branch line that connects the Harriman estate with the Erie railroad. Its purpose was, however, not only a private one, but to demonstrate the possibility of the use of such cars, carrying from 10 to 15 persons, on the branch roads of the system in place of combination freight and passenger trains.

Such a transportation vehicle now looms up as a rival to the self-contained electric car for such purposes. Although the car shown is the first of its kind constructed in America, several of a similar type are in active operation on European branch lines.



The Framework and Mechanism

WILD TRIP OF FIRST "MAID-OF-THE-MIST"

Only one steamboat has made the wild trip through the Whirlpool rapids of Niagara Falls, and that vessel was the first "Maid-of-the-Mist," the extraordinary feat being accomplished in 1861. The boat had proved a failure as a passenger steamer at the foot of Niagara Falls, and her owners had an offer for her if she could be delivered on Lake Ontario.

A crew of three volunteered for the dangerous experiment, and these, according to the Marine Review, were Noel R. Robinson, pilot; Engineer Charles Eckliff, and his fireman. On the morning of June 6, 1861, the lines were cast off and the little ship started on her stormy voyage. She arrived at

Lewiston, minus her smokestack and a few other things, 15 minutes later, but it is said that in that short period the pilot aged 50 years.

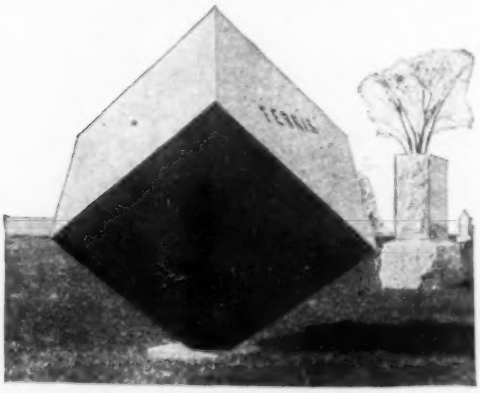
Anyone who has watched the Whirlpool rapids at close range can have nothing but unbounded admiration for the pluck of the three men.

FASTEST YACHT IN AMERICA

The 133-ft. steam yacht "Little Sovreign," which carried M. C. D. Borden from Atlantic Highlands to New York every week-day morning last summer, is the fastest of her dimensions in the United States, if not in the whole world. She covered a mile in 1.46 min. on a trial trip, which is a speed of 39.10 miles an hour. Few torpedo boats can exceed this speed. It cost Mr. Borden something over $100,000 to get the speed and comfort afforded by his rakish little flyer.

UNIQUE BALANCED MONUMENT

Although apparently insecure, this unique balanced monument in the Forest Hill cemetery, Utica, N. Y., is really held very firmly in position. It consists of a highly polished granite cube about 4 ft. square, one corner of which is set in a granite base sunk in the ground. A 3-cornered hole was cut to a depth of about 6 in. in the base to receive the corner of the cube.



Curious Monument at Utica, N. Y.

HOW PARIS LOOKED TO COUNT DE LAMBERT

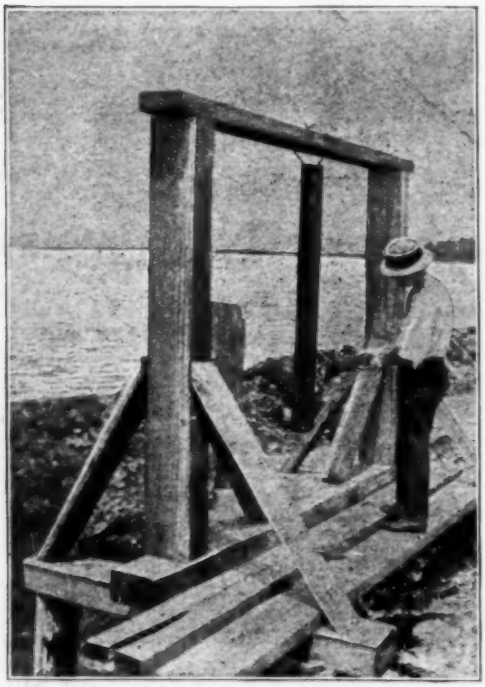
How Paris looked to Count de Lambert as he sailed high above the Eiffel tower and how Count de Lambert looked to Paris are far different propositions. The former is shown in the accompanying illustration, but the latter was practically impossible to show because all that the photographers on the ground could catch of Lambert's Wright aeroplane was a small speck, owing to the great height of the machine. Military men who watched from the Paris streets say it would have been almost impossible to strike him with the most improved aerial cannon, even though the height was only a matter of about 1,300 ft.

Lambert High Above Paris

The story of the wonderful flight, which caused all France to hail the count as "king of the air," was told in the last issue. He made his first attempts at flight as far back as 1894 on a Lilienthal aeroplane, and in 1908 took a prize at Monaco with a hydroplane of his own invention.

SECTION OF RAIL AS FOG BELL

When a fog engulfs the water front at Claiborne, Md., the unique bell shown in this illustration booms out



Unique Fog Bell

the call that directs the fishermen and other small-boat sailors to the pier. It consists of a 5-ft. piece of steel rail hung from a wooden scaffold. When struck with a bar of iron the sound can be heard a long distance out.

THE "AERONETTE" DANCE

The "aeronette" dance, now the rage in the ballrooms of Europe, is distinctive from other dances in the fact that the elbows keep time to the music as well as the feet. These, held sharply out, are inclined while turning in the dance evolutions in imitation of the working of the planes of an aeroplane in rounding corners. The dance, however, has its drawbacks as well as its interesting features, as there is great danger of receiving blows from flying elbows when the floor is crowded.

BORING MACHINE FOR STUMP BURNING

Burning, if done consistently, is considered by many farmers a much better method of removing pine stumps than dynamiting, pulling, or cutting and digging out. To burn properly, a trench must be dug a foot or so deep on one side, and an auger hole bored through on a downward slant from the other side. The auger hole is usually started just above the surface of the ground, and comes out on the other side just above the bottom of the trench. A fire is then kindled in the trench, and, as it burns, some of the fire is drawn up into the hole by the draft. This fire feeds upon the stump and the hole burns larger and larger until the stump is practically all consumed. Usually the stump burns down to a depth of 16 or 18 in. below the surface of the ground, which is well out of the way of the plow. The tar in pine, of course, aids materially in the burning, and it is on pine lands that the method is in use.

The holes are usually bored by an ordinary auger, but the work is so slow that specially constructed augers of the type shown in the illustration have made their appearance in many parts

Boring a Stump Before Burning

of the country, particularly in Alabama. The outfit shown weighs about 60 lb. and consists of a 1¼-in. ship auger about 6 ft. long, mounted on a

truck and standard, and turned by a crank mechanism. With this machine it is possible to bore holes 5 ft. deep in a very short time, and it is said that two men can bore and burn as many as 100 pine stumps a day.

A BATHTUB-SHOWER BATH CONTROVERSY

The relative merits of the bathtub and the shower bath in public institutions and hospitals was the subject of an interesting controversy at one of the sessions of the American hospital association recently held in Washington, D. C. Dr. R. W. Corwin, superintendent of the hospital at Pueblo, Colo., insisted that bathtubs were unsanitary, and should be excluded from hospitals in favor of shower baths. His main point was based on the allegation that patients with different diseases perform their ablutions in the same tubs.

In defense of the tub, Dr. R. R. Ross, of the University of New York, said that it was the only practical way to bathe children, because they could scarcely be persuaded to stand under a shower. Another point made by him was that women disliked to get their hair wet, which he insisted is unavoidable in shower bathing.

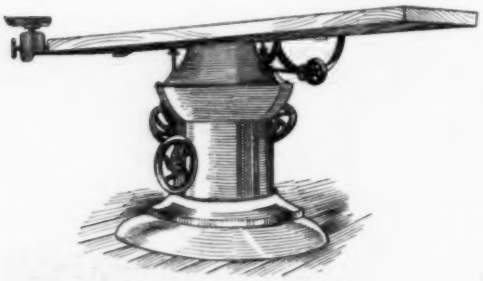
Ancient Tree Decorated with Electric Lights

GIANT FLORIDA LIVE OAK

In Dixieland Park, Jacksonville, Fla., grows this wonderful tree. Its branches spread 160 ft., shading at noon a circle of 190 ft. When the sun shines low, this tree casts a shadow of almost an acre in extent. The noted Spanish Cabaleros and adventurous Nevarro and Ponce de Leon sought its shelter on at least one occasion. Osceola, famous Seminole chieftain, camped under this oak while negotiating in Jacksonville before the Seminole war, several important treaties. The tree is being preserved by the park directors who have decorated its branches with incandescent globes which present a beautiful sight at night. The limbs extend several feet horizontally and are as large as a man's body.

GEAR-ADJUSTED OPERATING TABLE

The operating table shown in this illustration, although believed too heavy



Ingenious Operating Table

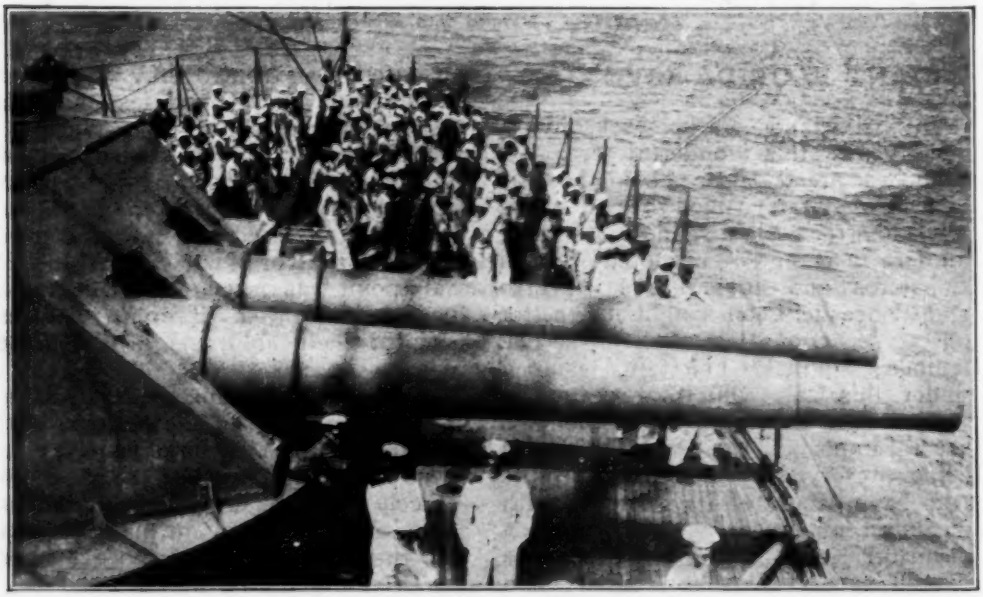
to be generally used outside of large hospitals, is nevertheless interesting from a mechanical standpoint. The inventor wondered for a long while why it was necessary for the surgeon, or his assistant, to take hold of the operating table and force it into the desired position, finally fastening it by means of setscrews, ratchets, or locking pins, and the result of his wondering is the table shown in the illustration.

It is a table that can be adjusted in any position required by modern surgeons without touching more than the hand wheels. This is accomplished by means of worm and spiral gear, without noise, jerking, or jolting. Either end or side can be tilted to any desired degree at the same time, and all positions are definitely adjusted the instant the hand leaves the wheel.

Such a table, could it be less heavy and more simple in its mechanism, would be in great demand everywhere.

ARTIFICIALLY ROLLING A SHIP IN ACTION

It would seem to the ordinary observer that a 16,000-ton, or even smaller battleship would be too huge to be made to roll by the assembled movement of the crew from side to side, yet it seems the simplest matter in the world to cause an artificial roll of from 5 to 10 degrees in this manner. It is called "sallying ship," and is a common occurrence on the American warships now that the new target practice regulations specify that firing must take place while the ship is rolling. If the sea is not rough enough to cause the ship to roll the required number of degrees, the crew is lined up on one side of the deck, and, at a signal blown on a bugle, run over to the other side.



"Sallying Ship" to Get a Roll of Over 7 Per Cent

ROAD IMPROVEMENT IN PENNSYLVANIA

By R. D. Beman, Deputy State Highway Commissioner

In the awakening of public sentiment in the cause of "good roads" which has been witnessed during the last few years Pennsylvania found itself confronted by a problem of no small degree, with its nearly 100,000 miles of public highways, but a very small percentage of which could by any stretch of the imagination be construed as "improved." When the legislature was finally induced to act, in 1903, it was along the lines of the "state aid" plan as already adopted by New Jersey, Massachusetts, Connecticut and other states. An appropriation was made of $6,500,000, to be expended during the ensuing six years, this amount being later supplemented by further appropriations amounting to $3,000,000.

An Improved Stretch of Winding Road, Showing Style of Fence Used

It was at first provided that the state should defray two-thirds of the cost of road improvement, but this proportion was later increased to three-fourths. The remainder of the expense is divided equally between the county and the township in which the road is located. Under the provisions of the Pennsylvania law the initiative rests with the township, which in this state is primarily responsible for the care of the public roads. A petition from the township officers, joined in by the county officials, asking for the co-operation of the state, is addressed to the state highway department. The survey, preparation of the plans and all details incident to the improvement of the road are taken care of by the department, but when the work is completed the road is turned over to the township, which is thereafter responsible for its maintenance.

This provision of the law has not worked out satisfactorily, as it has been found that the township officials, as a rule, fail to make the repairs that are necessary in the maintenance of every road. The state may eventually assume charge of the maintenance of all roads built under her supervision.

In taking up its work the state highway department found itself confronted at the outset by a scarcity of material. To one familiar with the rock-ribbed hills of Pennsylvania this

Warren County, Pa., Improved Road After One Year's Use

statement may seem paradoxical. It is, however, the unfortunate fact that much of the stone with which the state abounds is of little value in road-building. The best road material in the state is trap rock, found only in the extreme southeastern corner, and some of the trap will not unite or "bond." Through a tedious routine of experiments the department has, however, found that trap which, alone, will not bond can be used by mixing into it limestone screenings.

Throughout the greater part of the state trap cannot be used, owing to the prohibitive freight charges. Hence limestone composes the material from which the most of Pennsylvania's roads have been constructed, and yet the use of limestone is attended with difficulties. An ideal material in its bonding qualities, much of it is too soft, and its use means excessive cost of maintenance. Further experiments, however, have shown that limestone which, alone, is too soft can be united with some of the harder sandstones, quartzites, etc., and satisfactory results obtained. In some counties the expense runs high, because of an entire lack of either trap, limestone or any other suitable material. In states like Connecticut the question of material is of little moment, as stone of good quality lies ready for the road-builder all over the state, but in Pennsylvania the effort to obtain suitable stone has overshadowed all other problems confronting the highway department.

Pennsylvania improved roads are usually of the telford-macadam type, having a telford foundation and the upper courses of macadam. This form of construction is adopted because it enables the use of telford blocks of stone which may be utterly lacking in the qualities necessary in a material from which to make macadam. On some roads near large cities and towns, where the traffic is heavy, brick pavements have been laid, although at a cost nearly double that of macadam. In such cases the subsequent decreased expense of maintenance has justified the greater initial cost.

The question of grade has also been an important one in Pennsylvania, owing to the extremely hilly character of much of the state. Many steep grades, reaching in some cases 16 or 18 per cent., have been cut down to 7 or 8 per cent. In numberless instances roads lead over hill-tops when they could readily be led around the hill. Wherever feasible, the locations of such roads are changed, but here again the department's hands are tied, as it does not possess the right of "eminent domain," and hence is unable to do more than urge the township road authorities to institute the necessary action looking to a change of location. Sometimes this action is successful and sometimes the stubborn refusal to see the advantage to be gained by going around instead of over the hill causes the local residents to retain the old-time route, which was "good enough for their fathers and hence is good enough for them."

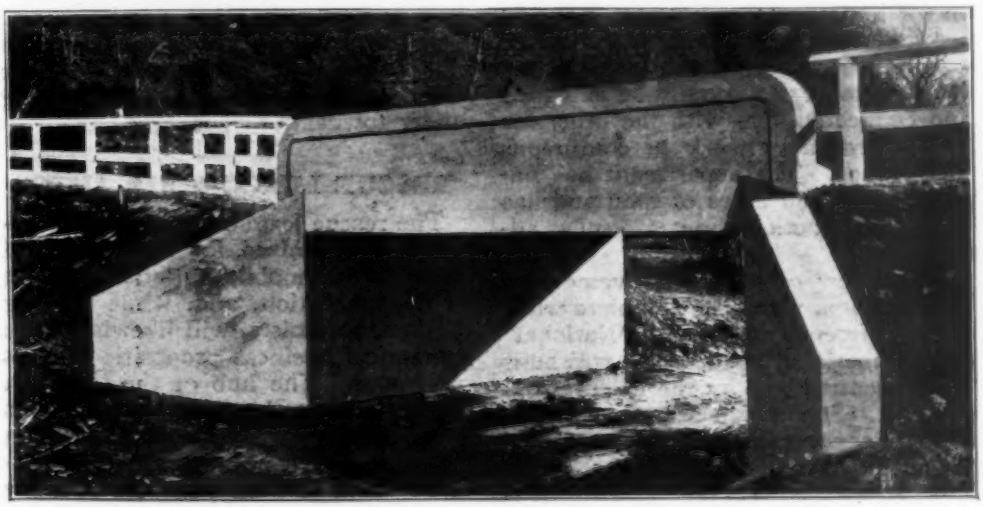
In its culverts and bridges the department has adopted the most permanent type, using in nearly all cases reinforced concrete. In some of its largest structures steel plate girders have been utilized. The use of wood in bridges, culverts or drains has been abandoned

entirely, the effort being to build structures which will cost nothing for maintenance.

At about the time of the inauguration of the state-aid system in Pennsylvania the problem created by automobile travel began to attract the attention of road-builders throughout the entire world, and the new department in Pennsylvania found itself confronted not only by the usual trials and difficulties attendant upon the upbuilding of a system and an organization and by the scarcity of suitable material, but also by the entirely new question of how to cope with the extraordinarily rapid deterioration of macadam roads under the wheels of automobiles. This condition, of course, did not exist on roads upon which brick pavements had been laid, but it was desired to find a form of paving which should cost less than brick and as little as possible in excess of macadam, and should also possess more resiliency than brick and at least as much, if not more, than macadam.

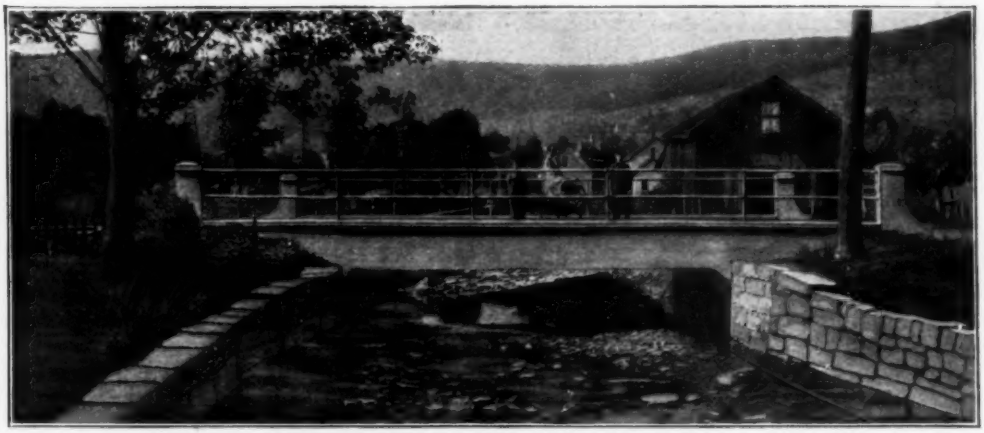
Working slowly, to avoid mistakes as far as possible, the department believes that it is close to the solution of the problem in the use of "asphaltic-macadam," composed of a mixture of asphalt and crushed stone. The roads which it has built of this type have not been long enough in existence to justify positive conclusions, but they have proved entirely satisfactory thus far, and seem to promise well for the future.

Two methods are followed, one known as the "penetration" method and the other the "mixing" method. In the former the crushed stone is laid and lightly rolled to give it a uniform surface, and the asphalt, heated to about 300° F. is poured or sprinkled into the interstices among the stone. This is followed by more rolling and by the addition of dry screenings. In the "mixing" method the asphalt and stone are thoroughly mixed before laying. This system seems to ensure the more complete coating of every piece of stone with asphalt, and produces a more perfect as well as more durable road surface. Tar has also been the medium of some experiments, but has failed to give the satisfaction thus far attained by the use of asphalt.



Cement Bridge, State Road, Forest County

Since the creation of the state aid system in Pennsylvania petitions have been filed for the improvement of about 4,650 miles of road. As the appropriations have been sufficient to build only a small portion of these roads the department has, so far as possible, select-



Cement Bridge, State Road, McKean County

ed for improvement those roads which are the avenues of travel for the greatest number of people, and which at the same time may eventually be extended and connected, one with the other, so as to form a network of continuous main roads. The department has finished about 630 miles of road and has under construction about 175 miles additional.

No review of road improvement in Pennsylvania would be complete without a reference to the old "National" or "Cumberland" road, which was built over a century ago by the federal government. Starting in Maryland it traverses Pennsylvania for about 80 miles and then passes into West Virginia and Ohio. The section in Pennsylvania crosses three counties in the southwestern part of the state. It was under federal supervision until 1835, when it was turned over to the state authorities. For 70 years thereafter tolls were collected for its maintenance. The receipts were insufficient to keep the historic old road in proper condition, and in 1905 the Pennsylvania legislature freed it from tolls, turned it over to the care of the state highway department and appropriated funds for the rehabilitation of the road. Portions of the road have been put into first-class condition and a number of stone bridges rebuilt, and with further appropriations the entire 80 miles in Pennsylvania will eventually become a magnificent highway. It is worthy of note that this road is the only highway in the state which is the property of the commonwealth, all other roads being under township or county control.

RESCUE LEAGUE FOR AUTOS

The rescue league for stranded automobiles, organized for St. Louis and its main automobile outlets, is unique in its conception, and, while proving a boon to autoists, will likewise prove a practical business proposition for its originator. The hub of the idea is a new garage on Forsythe road, which is to be connected by telephone with a series of boxes not unlike the police-box system of a city, located at many points.

These boxes will be free to members of the league, who, on becoming members, are furnished with keys. When anything happens to the automobile, all the autoist will have to do is reach the nearest signal box. If the trouble is a shortage of gasoline, a supply will be rushed to him. Reports of burst tires or broken machinery will bring a repair man to the spot with the accessories required, or if the car is completely wrecked it will be immediately sent for and taken in.

Budapest, Hungary, has a municipal bakery which furnishes wholesome bread to the poor at a very low price.

GERMAN ROTATING SAFES

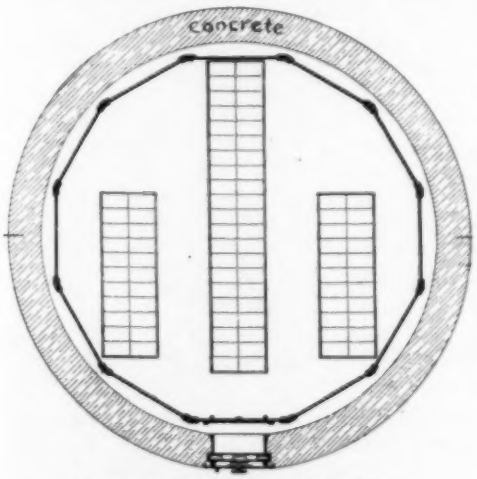
Continually Revolving Safes the Latest Burglar-Proof Scheme

By Dr. A. Gradenwitz, Berlin

The improved melting methods now in the hands of expert burglars in the form of gas "cutting burners" has so greatly impaired the burglar-proof qualities of existing safes as to warrant serious attempts to devise some new type that will resist their powerful effects. All the safeguards so far devised in this country against such burners are based on reducing their efficiency by increasing the thickness of the plates.

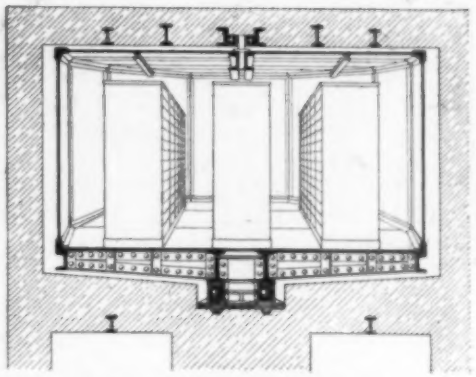
The unique safe shown in the illustrations, the invention of a German safe expert, and already installed in several of that country's largest banks, is entirely on a different principle. Instead of reducing the efficiency of the burners, it makes melting of the metal by such means absolutely impossible.

It is a safe divided into two parts, one part being the surrounding concrete or stone wall, and the other the armored safe proper. The wall section is stationary, but within it the armored safe is revolved by means of an electric motor fitted close to the lower ball bearings on which the safe is pivoted.



Closed Condition When Revolving

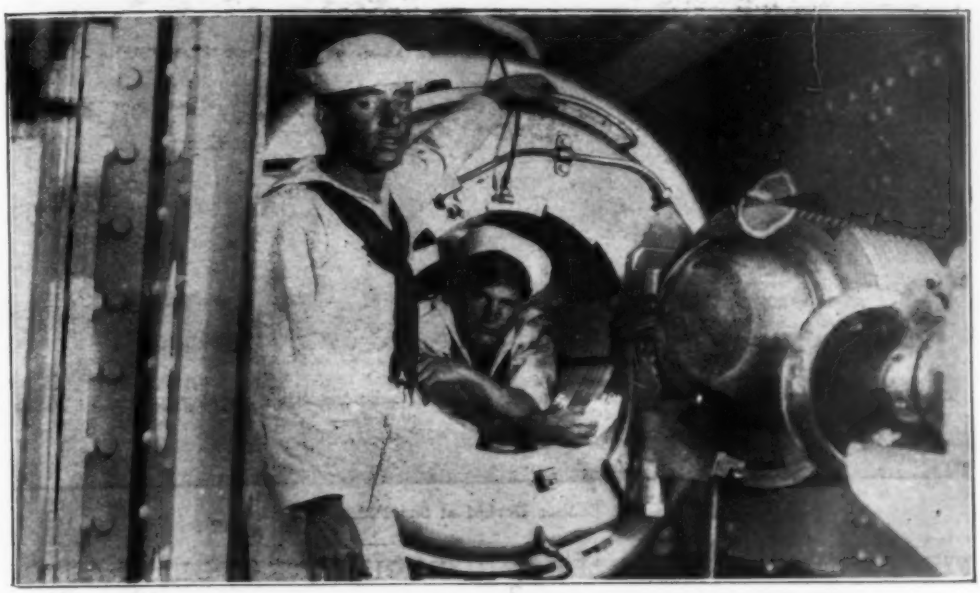
During business hours the safe is stationary, entrance to it being gained through the doors. During this period electric accumulators within the safe are connected with an outside charging circuit, which connection is broken when the closing hour approaches. A time-switch, likewise within the safe, is set to stop the motor at any given time the next morning, or the following morning should the day be Saturday. The doors are closed, and the motor is started by an outside switch, which, however, is not capable of stopping it again.



Position During Business Hours

The safe then commences to revolve, and continues this movement at a speed of about 3 ft. a second until stopped by the time-switch. Rotating at such a speed, the surface of the safe at any given point is continually changing, which makes impossible a successful attack by "cutting burners." Again, as the safe is designed as a polygon, the distance between the armor and the melting instrument in the hands of the burglar is changing constantly, and with such rapidity as to prevent any possibility of adjusting the burner at the proper distance. Any contact between the burner and the rotating wall would, to say the least, place the burner out of commission and endanger the operator. The same may be said of any other tool used in an attempt to break the safe open.

A Remarkable Instance of Change: Trinity Church, New York, Completely Surrounded by Skyscrapers



Breech of a 12-In. Gun

THE "BUSINESS END" OF A BIG GUN

The end of the gun from which the projectile is hurled is usually spoken of as the "business end," but the idea is somewhat erroneous. In reality, the business end of the gun is the part in which the charge is placed and exploded—the part from which the projectile is started on its mission of destruction—the breech.

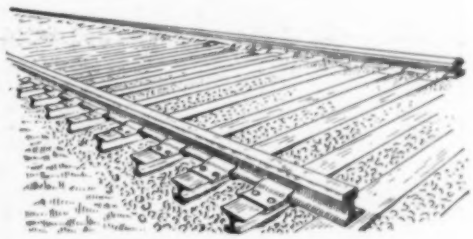
The illustration shows the breech of a 12-in. gun with a bluejacket reclining comfortably within. The gun hurls an 870-lb. projectile a distance of 15 miles with a muzzle velocity of 2,800 ft. per second. The charge required consists of four 52½-lb. bags of powder, which are ignited by electric percussion caps.

AUSTRALIA OFFERS LARGE AERIAL PRIZE

The government of Australia has offered a prize of $25,000 to the inventor or designer of a flying-machine for military purposes. An additional $25,000 has been raised by the public, making a total prize of $50,000 for which any Australian who makes his entry before March 31, 1910, may compete. The arrangements are in charge of the department of defense.

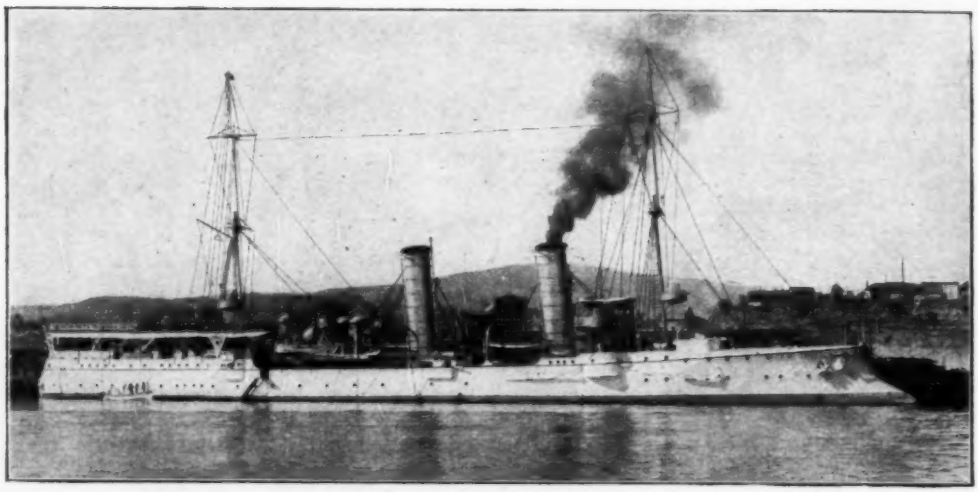
T-RAILS CONVERTED INTO RAILROAD TIES

In view of the ever-growing demand for substitutes for the wooden railroad tie, the Bessemer & Lake Erie railroad is experimenting with old T-rails on its lines running out of Greenville, Pa.



Old Rails as Ties

The T-rails are cut to the regulation tie length, and then securely anchored in the roadbed by rock ballast. The rails are clamped to the T-rail ties by means of iron fastenings.



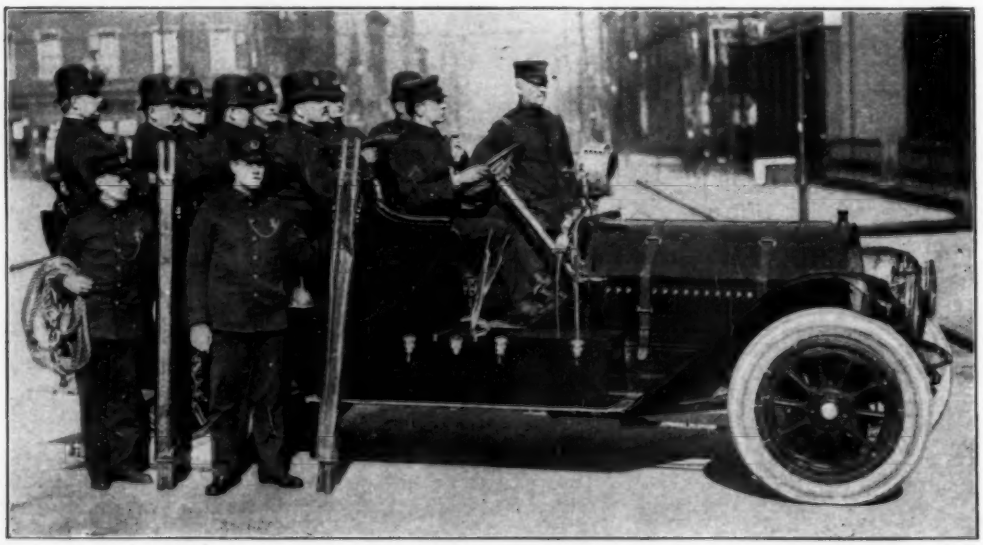
German Cruiser Docked at San Pedro, Cal.

FIRST CRUISER IN SAN PEDRO'S INNER HARBOR

The German cruiser "Arcona" was the first cruiser of any nation to be docked in San Pedro's new inner harbor, or channel. She docked at the city wharf in front of Fifth street, and remained there five days. During the stay of the visitor its officers and crew were entertained by Los Angeles, of which San Pedro is now a part.

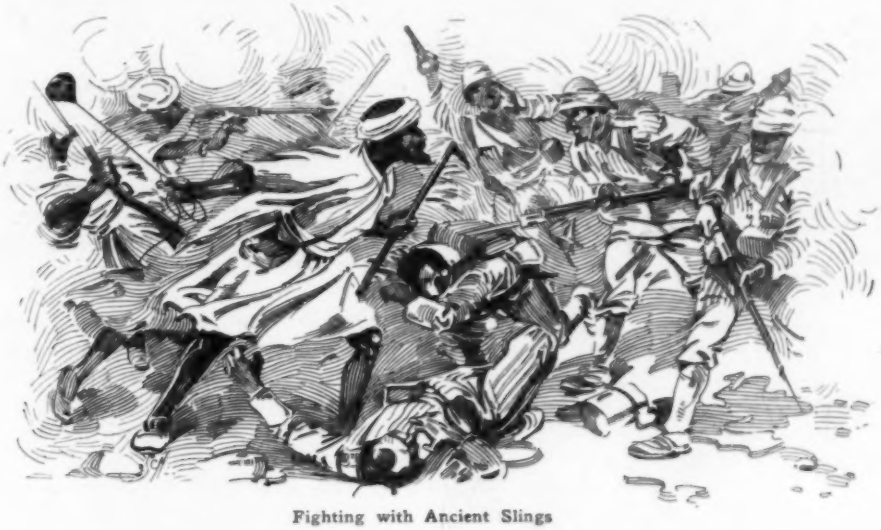
CINCINNATI'S POLICE AUTOMOBILE

The reproduced photograph shows the new police automobile of the Cincinnati force. In it are the 6-ft. policemen who are known as the "riot squad." The machine is equipped with two stretchers, a surgical and medicine chest, fire lines and nets, and everything a physician or policeman would require in answering emergency calls.



Carries the 6-Ft. Policemen of the "Riot Squad"

The machine is geared to run 65 miles an hour, and a speed of 50 miles is often reached on emergency runs. As is shown by the illustration, there is room for the driver and an officer on the front seat, and for seven policemen in the back section.



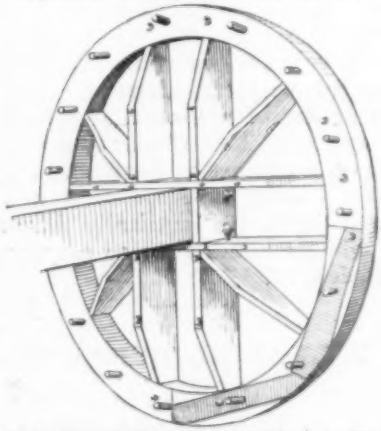
Fighting with Ancient Slings

SPANISH TROOPS FOUGHT WITH SLINGS

When fighting the Spanish at close quarters in Morocco, the Riffian forces often attempted to break up the bayonet charges of their enemy with stones thrown from slings. Often, when the forces met hand to hand, the stones were fastened in the slings and swung as slugs. The illustration shows a Riffian David using a sling of ancient design.

NEW BULL AND CALF WHEELS

The arms that make up the spokes in a bull wheel are usually spiked together and to the large wood shaft, thus making it necessary to completely rebuild the wheel each time a shaft is replaced or when the wheel is moved. A western inventor has brought out a wheel that has new structural features. The wheel is known as a "take down" wheel that can be detached from the shaft. The arms are bolted to the shaft instead of being spiked in the usual manner and further efficiency and strength are secured by the fact that each arm has a full bearing on the square shaft. Should it become necessary at any time to replace the shaft, this can be done without rebuilding the entire wheel and, consequently, at much less expense than the cost of building an ordinary wheel. Calf wheels are built in like manner.



"Take Down" Wheel, Detachable from Shaft

The Arctic club, of Seattle, Wash., has petitioned the Alaska road commission to build a road into the Iditarod country, the new gold diggings.

AMUSEMENT ON BOARD WARSHIP

Although in times of peace, as well as in times of war, the Jackies on

In Times of Peace

the American warships have many tasks to perform, there is time for amusement of a kind that appeals to one and all. This illustration shows a pie-eating contest on board the U. S. S. "Ohio." Four Jackies, their hands tied behind them, are frantically devouring pie, while a hundred or so more watch with delight.

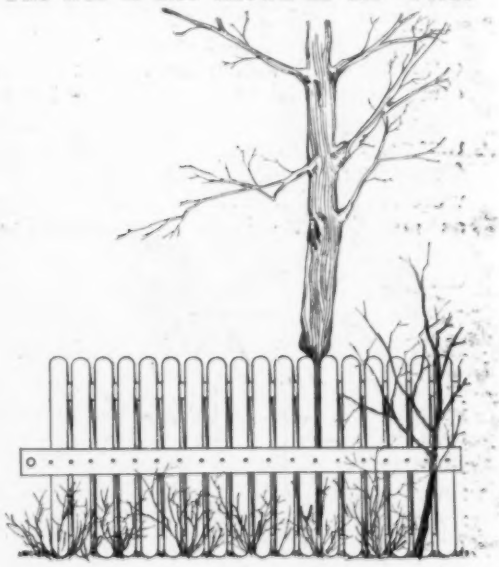
SUBMARINE SIGNALING

Submarine signaling, in which a bell is rung under water and the sound is carried through the water to a receiving apparatus in the hulls of vessels, is steadily being developed. The total number of vessels now equipped with receiving apparatus is 550, and there are no less than 109 bells in operation in various parts of the world, the most recent of these being in the straits of Gibraltar and on the Irish coast. In addition to these transmitting bells, are many others on vessels. These are used as is the wireless, to call for assistance in times of accident.

It was such a bell on the trans-Atlantic liner "Republic" which aided the vessels called to her assistance by wireless in finding her in the dense fog.

TREE GROWS THROUGH IRON PIPE COIL

A remarkable example of the tenacity with which the China tree clings to life is shown near Columbus, Ga. One of these trees has grown up through an abandoned iron pipe coil, lying outside an ice factory. The spaces between the spiral pipes are only half an inch wide yet the hardy tree has pushed its way up through the coil, and continued to grow until its trunk is 4 in. in diameter. In spite of the fact that at two places the trunk has had to pass through half-inch spaces, it has retained its vitality, although it does not bear leaves plentifully, nor present the healthy appearance of a normal tree. The tree is also known as the "Pride

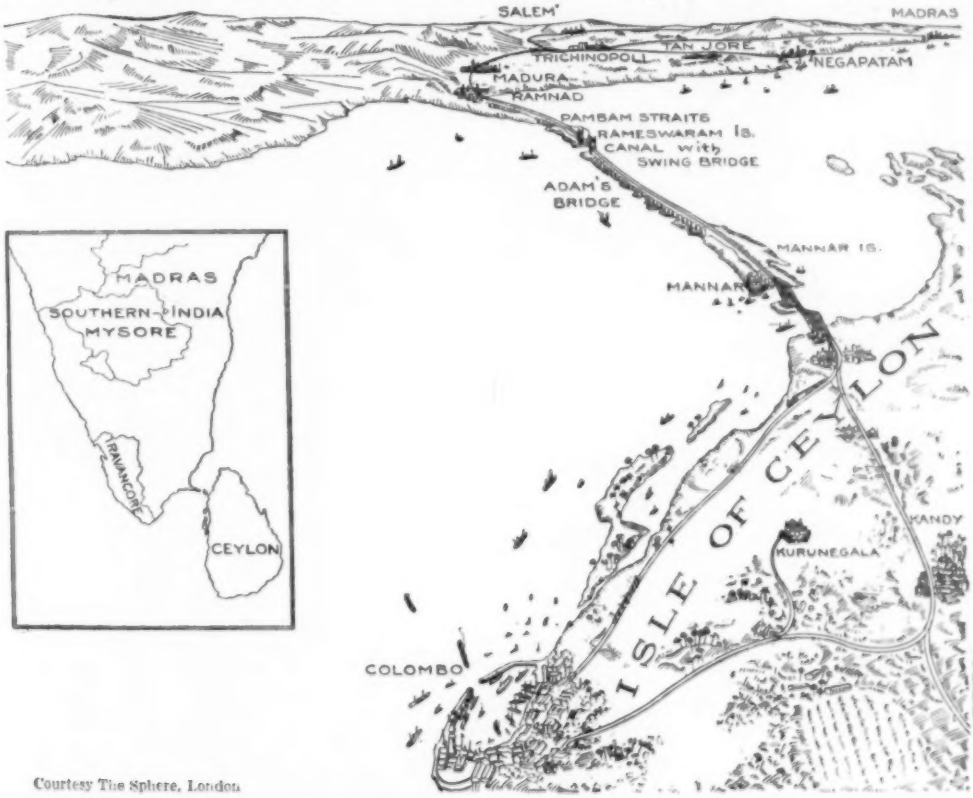


Tree Adapts Self to Adverse Conditions

of China," and while numerous in the southern states, is indigenous to Asia.

RAILROAD TO LINK CEYLON WITH INDIA

Emboldened, perhaps, by the successful completion of the railroad connecting Key West with the mainland of Florida, the first railroad system to run over an ocean, a scheme is being advanced that will link the island of Ceylon with the mainland of southern India. Between the island and the mainland are several small islands and a submerged reef. The distance across



Courtesy The Sphere, London

Another Ocean Railroad

from Ramnad to Mantoddale is about 80 miles, and this entire length will be spanned by concrete viaducts and steel bridges.

The project also calls for a ship canal to be cut through the island of Rameswaram. It will be about 70 ft. wide at the water level and three miles long. This, and the other features are clearly shown in the illustration.

FRESH AIR CARS ON ERIE SUBURBAN TRAINS

The latest addition to the usual type of cars used in the make-up of a passenger train is a fresh-air car, which has doors, ventilators, and alternate side windows wide open. The idea has been put in practice by the Erie railroad on some of its suburban trains, in answer to the protest made by many commuters against the steam heat and stuffy atmosphere of the regular cars.

Any person riding in the fresh-air cars is privileged to close the window next to him, but has no right to close other ventilation openings. The will of the majority of those who ride in the cars will control the turning on of the steam heat, which may be wanted in very cold weather, but those who find the cars too cold can always move to other cars in the train.

DIOPTRIC ELECTRIC LETTERS

A Liverpool concern has introduced an electric sign system in which each letter is fitted with a dioptric lens and lighted with a single lamp, the effect being a uniform illumination of the whole letter, as is shown in the illustration, instead of the part of the letter immediately in front of the electric bulb being more illuminated than the extremes of the letter. The method also produces the effect of automatic flashing, due to the movement of the observer.

The letters are built up separately in galvanized steel cases, and measure 15 in. by 12 in.

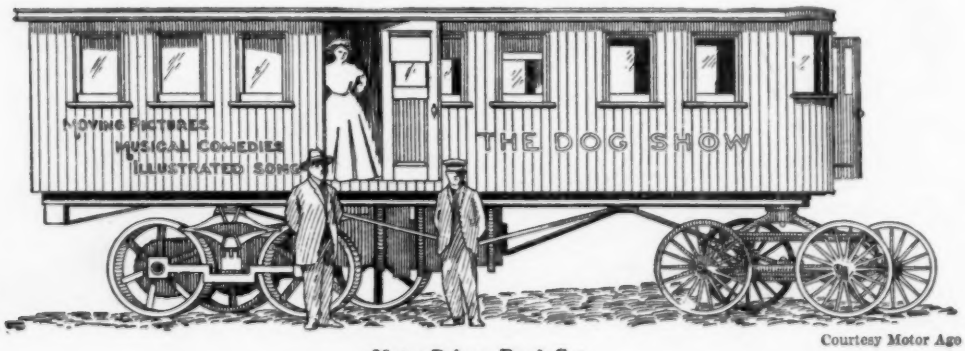
MOTOR TRAIN CARRIES DOG SHOW

One of the most curious highway-traveling equipages in this country is the means by which a dog circus moves from town to town. The main unit is a car, 26 ft. long and 6½ ft. wide, driven by a 50-hp. engine. This draws the equipment carts and the carts in which the dogs travel, and in itself contains a comfortable traveling home for the showman and his assistants, as well as a workshop containing repair kits, dynamos and all that is necessary for the mechanical end of the show. A speed of 4 miles an hour can be maintained over almost any kind of a road. Steering is accomplished by means of the 4-wheeled forward truck, which is turned by a work gear.

CHEAPER CRUDE RUBBER PREDICTED

That relief is in sight for the manufacturers of automobile tires is predicted by George E. Anderson, consul-general at Rio Janeiro, who believes that lower prices for crude rubber, regularity in delivery, and a more permanent price range will come within the next three or four years. The rubber plantations, which at the present time are producing about one ton of rubber to 10 acres of plantation, are not now numerous enough to fill the demand, but the business has become so prosperous that the acreage is being extended.

If the demand for rubber increases at the present rate, the world ought to be consuming in, say, 1914, about 105,000 tons. What the world production will be at that time is, of course, problematical, but it is believed that plantations would be producing more than enough to supply the world's market. Such supply will be reasonably regular, will be based by a known cost price, and there will be no occasion for the immense variation in price which has characterized the rubber market for the past two years. In February, 1908, rubber was quoted at about 66 cents per pound. In July, 1909, before the



Courtesy Motor Age

Motor-Driven Road Car

crop season closed, the prices were $2.10 per pound.

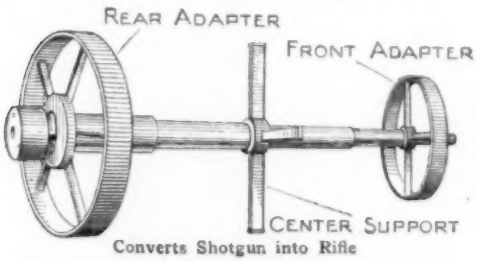
The rubber industry of Brazil produces about 40,000 tons of para rubber, and dominates the rubber markets of the world.

SUB-CALIBRE TUBES FOR BIG GUNS

The Idea Might be Used the Same Way in Shotguns

The illustration is a drawing of the sub-calibre tube used by the U. S. coast artillery troops in practice. Inserted in the barrels of the big 10 and 12-in. rifles they make possible the discharge of 1-lb. projectiles in place of the costly 10 and 12-in. projectiles. The wheels at the rear and forward ends of the tube and the legs in the center hold it in position within the big rifle.

It is suggested that the idea could also be adopted for single-barrel shotguns as a means of converting them into 22-calibre rifles. The sub-calibre tubes could be constructed along similar lines as the one here shown, and the result, it is believed, would be a great improvement over the 3-barrel guns now on the market. These cost anywhere from $100 to $200 and are rather cumbersome. Of course, the sub-calibre could not be removed and put in position in an instant, but the hunter usually knows beforehand whether he is hunting for rifle game or shotgun game.



Converts Shotgun into Rifle

Nearly all the cooking in Japanese cities is done in public ovens, maintained at convenient places at moderate cost to patrons.

SPIRAL STAIRCASE OF FERRO-CONCRETE

This highly artistic concrete staircase attracted much attention at the Franco-British exhibition in London because of its graceful, slender lines. It would seem too frail to bear many people at once, but its appearance belies its strength. Its spirals rise to a height of 27 ft. from a foundation only 16 ft. square.

Graceful Concrete Staircase

BELOIT MAN FLIES

The first private individual in America to purchase a Curtiss aeroplane is A. P. Warner, of Beloit, Wis. After his first dozen flights, nearly all of which extended over half a mile, he remarked, "There's nothing to it but joy." He expects to make many long flights in the future.

A SCIENTIFIC FLY TRAP

This fly trap is based on the principles that a window, by reason of the light, always attracts insects, and that

Appearance of Trap on Window or Door

flies and other insects invariably move upward. In doing so they are led by the guides until the opening of the trap is reached, and then, as the glass forms the inner side of the trap, they continue to crawl upward without being frightened away by a surface they are not accustomed to until the upper, or death chamber, imprisons them.

The trap consists of an ingenious cylindrical-shaped wire body, held in place on the glass of a window or door by means of metal and rubber. Its construction and its guides are shown in the drawing, while its appearance on a window or door is shown in the photograph. After the trap has caught the flies, it is submerged in boiling water and then emptied. Placed on a window of a business house in Los Angeles, it caught 658 flies in 10 hours.

Contracts have been let to the Great Lakes Engineering Co., to build three 15,000-ton freighters, the largest ever constructed on fresh water.

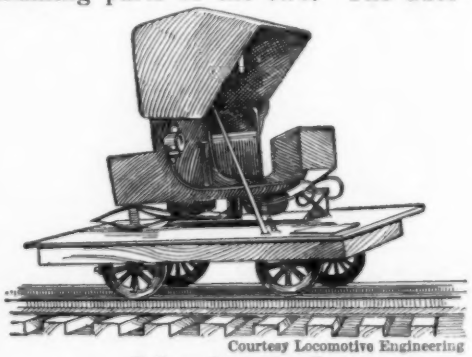
GREATEST ELECTRIC PLANT TO TAKE NITRATES FROM AIR

Attention is being drawn to one of the largest individual orders for electrical generating plants ever placed in Europe, but of far more interest is the mission to which the plant is to be put. The order will form just one-half of the power equipment of a generating station in Christiana, Norway, that, when completed, will be the largest electrical power station in the world, and the work the electricity is to do will be the production of saltpetre from atmospheric nitrogen. Or, in other words, the extraction of nitrates from the air, a description of which, by an American electrical process, was published in this magazine some time ago.

The contract just given calls for five 3-phase generating units, with direct-coupled exciters for coupling to water turbines of 14,000 hp. at 250 revolutions per minute. Each of these generators will weigh about 200 tons.

AUTOMOBILE HAND-CAR COMBINATION

This unique, but effective, railway inspection car is formed by removing the propulsion mechanism from an ordinary hand car and the wheels from an automobile and combining the remaining parts of the two. The auto-



Courtesy Locomotive Engineering

Railway Inspection Car

mobile engine is geared to the rear truck of the hand car by means of a chain drive.

HEAT

The Nature of Heat and How It Is Measured

By J. J. Gordon Ogden, Ph. D., Professor of Physics, Fifth Ave. High School, Pittsburgh

[This is the first article of a series by Dr. Ogden, in which well known subjects will be discussed from the standpoint of their relation to modern mechanics. Succeeding articles will include Liquid Air, Steam, Boilers, Ice, Radiation, etc.]

What is heat?

Oftentimes the simplest question regarding every day phenomena will confound the wisest philosopher. We become so familiar with effects that we rarely bother ourselves with the causes. We do not distinguish between familiarity and knowledge. Could we but see all that happens when a match burns, we would be the witnesses of a battle, besides which all the conflicts of men with men would pale into insignificance. Thousands of trillions of molecules clashing with enormous velocity against each other. Countless brigades of contestants forming and reforming into line of battle. Grand divisions of molecules, almost infinite in number hurled upon other divisions, make Pickett's famous charge at Gettysburg seem like a child's game with toy soldiers, if we consider only the units in the struggle. Could we but see all that takes place within a bar of iron when we either heat or cool it, the definition that "Heat is a form of motion" would readily be understood.

Matter is made up of particles called molecules, so small, that Sir William Thomson estimated that if a drop of water were magnified to the size of the earth, the molecules of water would each be less than the size of an ordinary base-ball and larger than small shot. When we apply heat to a bar of iron these molecules, which are forever moving, move a little faster. If we cool the iron they move a little slower. The same thing is true of a liquid or of a gas. There is this difference, though, in the character of the molecular motion in the three conditions in which matter exists:—In solids, the molecules move back and forth, just like tiny pendulums; in liquids, the molecules wander all around without any apparent aim, and in no regular path; in gases, the motion is supposed to be in perfectly straight lines. If we could stop the motion of the molecules in a body, the temperature of that substance would immediately drop to no temperature at all. This point, called the "absolute zero," has never been reached, although, as in the case of helium, we have come within close hailing distance of it. We are, therefore, unable to improve upon Tyndall's definition, that heat is a mode of motion. The more motion of the molecules, the higher the temperature of the body; the less motion, the less temperature, and, were the tiny particles of matter, known to us by the name of molecules, absolutely without motion, there would be absolutely no heat.

We are all familiar with the effects of heat upon the body, and readily recognize the presence or absence of heat by our perception of temperature. The body, however, is an unsafe guide to the real condition of substances with respect to their temperature. A person, returning from a walk in zero weather, entering a hallway where the thermometer registers 50° F. has the impression that the hall is warm, while some one else, who enters the same hall from a room where the temperature is 75° F., considers the hall to be quite cool. Hence the need of some instrument which will tell us exactly the condition of a body with respect to its temperature. This instrument we have in the common thermometer. The first practical thermometer was invented by Galileo, prior to the year 1597, and consisted of a glass bulb, filled with air dipping into a vessel containing colored water (Fig. 1). When the air in the bulb became hotter, its molecules moved faster and exerted

more pressure upon anything with which they came in contact. They consequently pushed the liquid down the tube. When the air cooled, the reverse happened and the atmospheric pressure forced the liquid up the tube. This tube is marked with an arbitrary scale. It was soon found that in order to rise to the dignity of an accurate measurer of temperature, the thermometer must be fitted with a standard scale. The temperature at which water boils was finally adopted as one of the important markings, while the freezing point of water was adopted as the other. In the Fahrenheit scale so commonly used in the households of this country and England, the boiling point is placed at 212°, and the freezing point is 32°. It is interesting to learn how Fahrenheit figured out these odd, cumbersome numbers as the chief points in his scale. He planned to make a thermometer that would tell the absolute truth about the temperature of a body. He did not want to begin his scale with the freezing point of water, as he knew well enough that there was a lower degree of temperature. Fahrenheit was living in Dantzic at the time of his experiments, and knew from many years' experience just how cold it was in that city in the coldest weather. He found that he could exactly reproduce this temperature, anytime, anywhere, by mixing salt with pounded ice. This temperature, he concluded, was the lowest limit of heat, since neither nature out of doors, nor man in his laboratory, could go any lower. Accordingly he put some mercury into a tube and bulb, plunged it into a mixture of salt and ice, and scratched a zero mark on the glass at the top of the mercury column. This he deemed to be absolute zero. He then calculated the mercury volume at that temperature and found it to be 11,124 parts. Next he placed the same thermometer in a mixture of ice and water. The mercury promptly expanded and occupied 11,156 parts by volume, or 32 parts of an increase over the zero volume. Accordingly he scratched the number 32 at this new height of the mercury column, and called it freezing point of water. Next he placed the thermometer in boiling water. The mercury expanded to 11,336 parts or 212 parts higher than zero. This he called the boiling point of water. He divided the scale between 32 and 212 into 180 equal divisions, which he called degrees, and his scale was complete. We shall see later that Fahrenheit was very much mistaken in his belief that he had reached the absolute zero of temperature, as that point is about 459° below where he conceived it to be. Ice at Fahrenheit zero is red-hot as compared with the temperature of liquid air.

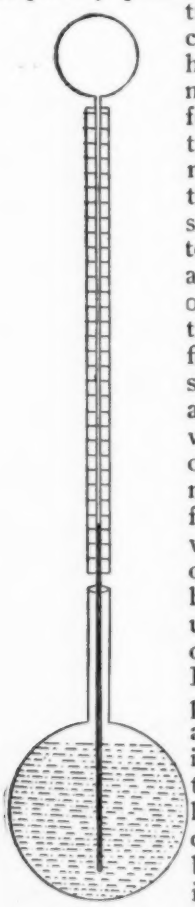


Fig. 1.
Air Thermometer

The Centigrade scale, used by scientists everywhere is simpler than the Fahrenheit, in that it has 100 steps or degrees between freezing and boiling.

Mercury is the liquid commonly used in the construction of thermometers. It expands and contracts more than the glass tube in which it is contained, and therefore is used as an index which points out faithfully the rise and fall of temperature. Mercury, however, has its limitations as a temperature marker, since it solidifies at about 38° below zero on either scale, and boils at 674° F. The boiling point of mercury may be considerably raised, however, on the principle that the boiling point of a liquid rises with the pressure exerted upon it. If the space above the mercury in a thermometer be filled with an inert gas like nitrogen or carbonic-oxide, the pressure of the gas will constantly increase as the mercury rises,

and prevent boiling even at 950° F. At this temperature, however, the glass begins to soften, and renders its use impracticable. By using fused quartz, the latest friend of the chemist and physicist, as a thermometer tube, mercury may be used for the determination of temperatures as high as 1300° F. For temperatures below the freezing point of mercury it is quite evident that some other substance must be used. Alcohol is most generally used, but such thermometers are very irregular in their action. Alcohol freezes at 168° F. Pentane is very useful in the construction of low temperature thermometers as it remains liquid at the exceedingly low temperature of 328° F. For the determination of temperatures still lower than this, a gas thermometer must be used. The hydrogen thermometer is the final court of appeal, to which all the readings of the other types of thermometers must be referred, as regards both high and low temperatures.

The manufacture of the modern thermometer has been brought to a high degree of scientific accuracy, and an outline of the process may not be uninteresting. First of all, glass tubes are drawn out to lengths sometimes exceeding 300 ft. When cool, these tubes are cut into lengths of about 4 ft., called "canes." These canes are carefully inspected and only those that have an approximately uniform bore are accepted. This means that only about three or four out of 75 canes are passed, the rest being "scrapped" as imperfect. The uniformity of bore of a thermometer tube is the important element in the manufacture of tubes. In some thermometers this bore is finer than the finest hair, although it looks to be larger owing to the magnification produced by the curvature of the glass around it. These canes are next cut into suitable lengths, and glass bulbs are blown at the end of each. A large bulb with a small bore tube will make an "open range" thermometer, while a small bulb and a large bore tube will produce a thermometer where only slight movements of the mercury column are required. The bulb and tube are then heated to a very high degree in order to drive out as much of the air as possible; while hot, they are plunged, open end down, into mercury, and the mercury is then forced up into the tube by atmospheric pressure, as the tube cools. This is repeated a number of times, until the requisite level is reached. These tubes are again strongly heated in hot sand to expel the last trace of moisture. The bulb is next heated in a Bunsen flame in order to boil the mercury and drive out the remaining air. It is then cooled in ice water and the tube cut off very close to the length of thermometer desired. The top part of the tube is now drawn out until it is very thin, but still traversed by a minute hole at the center. Strong heat is once more applied and the mercury made to fill every portion of the bulb and tube, and some of the mercury escapes through the minute hole. At this instant a hot blow-pipe flame is turned upon the upper end of the tube and it is sealed. The tube is then complete, and ready for graduation. It is laid upon a strip of metal and lines are scratched upon this blank, showing the height of mercury at what are termed "test" points, generally 32° and 92°. This scale is then subdivided by machinery into the subdivisions required by the distance between these points, varying from an inch or so, to the hundredth of an inch. This scale is kept for the thermometer which determined its points, as no two thermometers have exactly the same scale. Should the tube be broken, the scale is of no use as it would fit no other thermometer. When a high grade thermometer is sent out, there is always sent with it a slip of paper, showing its variations from the true standard, between different points. This is necessary from the fact that it is absolutely impossible to make a tube of uniform bore, and the expansion is therefore unequal. Every thermometer is therefore compared with one that is as near perfection as possible, and the necessary corrections noted. Strange to say, a thermometer,

in order to be reliable, has to be seasoned. Certain molecular changes take place in the structure of the glass and these can be determined only by careful observation over a period varying from one to two years. The thermometers are kept in a vault for that length of time, and are regularly inspected and the change in bore noted. After the thermometer has passed all these examinations it is put on sale, and if we are inclined to grumble a little at the high price asked for a few ounces of iron, glass, and mercury which make up a thermometer, we should remember that it is skilled labor, not material, for which we pay.

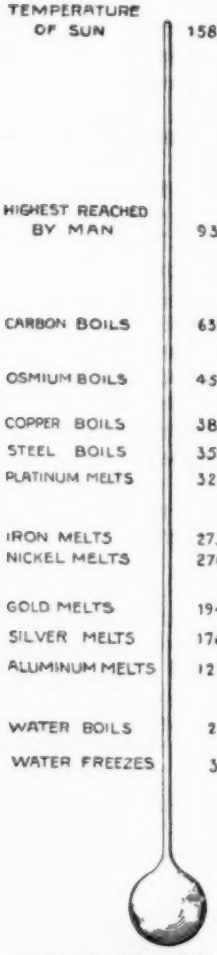


Fig. 2.—Heat Table

Another type of thermometer is one which depends upon the well known fact that under the same degree of heat different metals expand at different rates. Two ribbons of dissimilar metals, like steel and brass, are firmly soldered together and coiled into a spiral. Owing to the unequal expansion of the two metals, this spiral becomes longer or shorter as the temperature varies. This movement of the spiral is magnified by a series of delicate levers, and is shown in the movement of a hand on a dial bearing a scale that has been graduated into degrees. Metallic thermometers are unreliable. After a time, the molecules of the metals become set, and refuse to act exactly as before. This is not true when the highest grades of steel and brass are used.

Mercury thermometers answer all ordinary requirements for domestic and industrial uses but they fail utterly when we attempt to use them for measuring high temperatures. We are compelled to use for this purpose an instrument known as a "pyrometer" or "fire measurer." The simplest pyrometer is a rod of graphite enclosed in a tube of iron. The graphite expands and contracts more than iron, behaving just as the mercury and glass in a mercury thermometer. There is a limit to the use of this pyrometer as the very high temperatures met with in furnace work will melt the iron and boil the carbon. Carbon has the curious property of boiling before it reaches its melting point.

A strip of platinum is sometimes used as a pyrometer. It is heated by a current of electricity to a white heat, the temperature of which is 3400° F. An ordinary thermometer is placed, say three or four feet away from the white-hot platinum strip, and the rise in degrees noted. Then the same thermometer is placed near to the furnace whose temperature is to be estimated. When the exact distance is determined by experiment in order that the thermometer may indicate the same temperature as was shown when used with the platinum strip, it is then receiving the

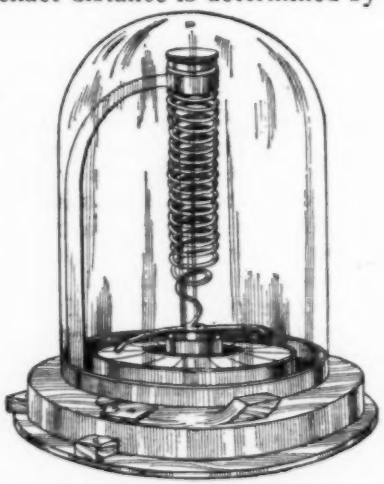


Fig. 3.—Metallic Thermometer

same heat from the furnace as it had previously received from the heated platinum. Now, heat varies inversely as the square of the distance from its source. If the thermometer receives the same heat from the furnace as it had previously received from the strip, but at twice the distance, then the furnace is four times hotter than the strip. This method is known as "radiation," is necessarily unreliable, and is only used for approximation.

We now turn to electricity as our temperature measure, and here we have the most accurate appliance known to science for this purpose. Some years ago the late Professor Langley invented an instrument which he called a "bolometer." This wonderful invention is capable of determining very slight changes in temperature, so slight as the millionth of a degree. It is used in connection with an instrument known to electricians as a "Wheatstone bridge." This bridge corresponds to a very sensitive pair of scales or balance. The slightest variation in a current of electricity may readily be detected. One of the four arms of the bridge used by Langley, was an exceedingly thin strip of platinum—the bolometer. This platinum strip was made by first plating copper with a thin film of platinum, and then dissolving the copper with nitric acid. The film was only one thirty-two-thousandths of an inch in thickness. The electrical resistance of a conductor increases with its temperature. When the thin platinum strip was subjected to the slightest heat, its resistance rose, and the increase in temperature could readily be calculated from the change in the value of the electrical current.

The bolometer, however, is really a laboratory instrument, and would not be available for furnace work. In order to arrive at the temperature of a blast furnace, we are therefore compelled to take advantage of another curious property of metals, with respect to their relation to electricity and heat. If two dissimilar metals, such as antimony and bismuth, or platinum and rhodium, have a common point of contact, a slight current of electricity will be produced if this junction be either heated or cooled. The two elements are called a "thermo-electric couple." These couples, like the bolometer, are to be

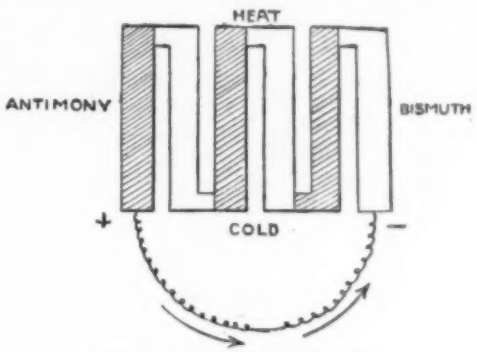


Fig. 4.—Thermo-Electric Couple

used in connection with a Wheatstone bridge, and the temperature of the furnace calculated from the slight change in resistance produced by the unequal heating of the dissimilar metals.

These couples may be placed directly in the furnace, provided the platinum-rhodium couples are used. Should the temperature rise above the melting point of either of the metals, the radiation rather than the direct method must be used. Le Chatelier's thermo couple, of which one element is platinum, and the other platinum containing 10% of rhodium is in common use, and permits of measurements as high as 3100° F.

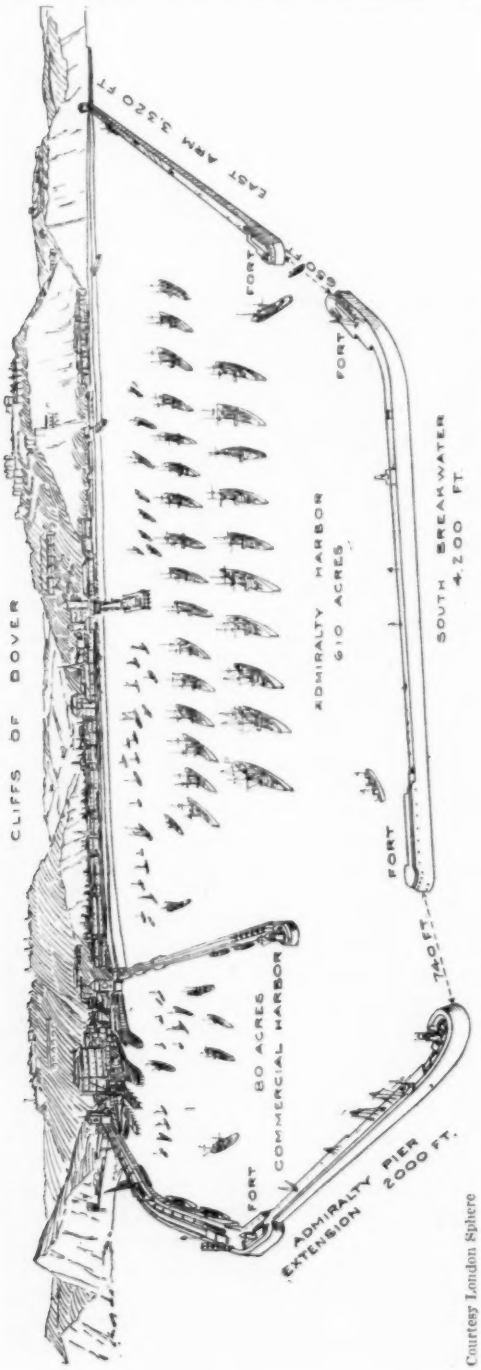
It is hoped that sometime a couple may be constructed whose elements will consist of two varieties of carbon, but this has not yet been done.

With all forms of pyrometers, after a certain temperature has been reached, temperature calculations as to the precise degree, cease to be accurate, and must necessarily be approximated.

Other methods for determining high temperature, such as vapor-tension, dissociation of metals, fusion, and specific heat, have been devised, but none are better than the form known as Le Chatelier's. The melting points of lead, silver, gold, and palladium all lie within the range of this instrument. It is of especial value in the treatment of porcelain and ceramic ware generally, and has almost revolutionized this important industry.

THE GIBRALTAR OF THE ENGLISH CHANNEL

With the opening of the great naval harbor at Dover last October, that port, one of the oldest in the world, became one of England's strongest naval bases, and the Gibraltar of the English channel. The stupendous task of constructing the three great fort-topped walls or breakwaters that form it was actively commenced in 1898, and today the British fleet has a home base from which it can easily strike out into the North Sea.



Courtesy London Sphere

A general idea of the harbor is shown by the illustration. The main, or naval basin, has a water area of 610 acres, affording ample accommodation at low tide for a fleet of 25 "Dreadnoughts," and the attendant smaller craft, such as gunboats, torpedo boat destroyers, submarines and colliers. In addition to this basin is a smaller one, covering 80 acres, for ordinary shipping. Five forts frown from advantageous points on the harbor walls, and other forts on the chalk cliffs of Dover are ready to reinforce them, should England's sea fighters allow an enemy to come within range.

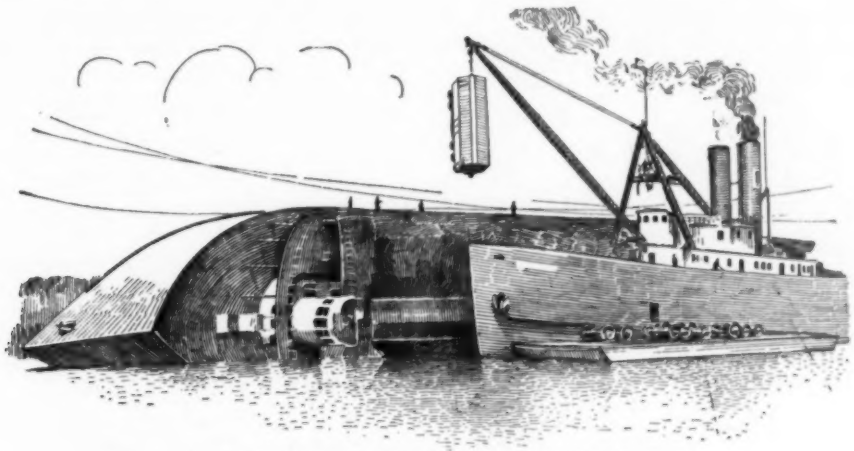
ELECTRIC ROAD TO SERVE FREE LUNCH

The new plans for improvement in service and equipment of the Oregon Electric Railroad Co., include the serving of free lunch on its run from Portland to Salem, Ore., a novelty unique in electric road annals. The four trains on which this service is about to be inaugurated will be vestibuled, and will be made up of three cars, one of which will be an observation car 62 ft. long.

The observation cars will have a platform, 9½ ft. deep, at the rear ends, covered by a dome and protected in the same manner as such cars on steam roads. Brass railings will protect the platform, wicker chairs will be used for the comfort of the passengers, and a plate glass partition will divide it from the body of the car. The main section of the car will have wide windows, and heavily upholstered chairs

will be provided. The front part of the car will be a smoking compartment and buffet. A porter will be in charge, and at meal times a light luncheon, consisting of coffee or tea, and toast or rolls will be served free.

ing 2 lb. of veal to 1½ lb. of beef. To this is sometimes added onions, or other flavoring, such as spices. At least, this is how the hamburger was made in San Pedro, Cal., when visited by the German cruiser "Arcona."



Wrecking the Car Ferry "Ann Arbor No. 4"

RELIEVING SHIP OF CARGO OF CARS

A train of 24 ore cars ran away in the railroad yards at Manistique, Mich., and did not stop until they had boarded the big steel car ferry "Ann Arbor No. 4" and piled up in a heap on one side of the car deck, causing her to turn on her side and sink at the dock.

Before the boat could be righted it was found necessary to cut away many of the plates of the hull to hoist the cars out. The illustration shows the powerful wrecker "Favorite" lifting a 39,000-lb. car at the end of her giant boom. The accident involved an expense of many thousands of dollars.

HAMBURGER DEVOURED BY GERMAN NAVY

Every nation has one or more special dishes which form the usual diet of the enlisted men of the navy, and Germany's offering to its fighting men of the sea is hamburger steak, and plenty of it. It is the main portion of nearly every meal, and is often made by grind-

OIL-ELECTRIC LAMP FOR MINERS

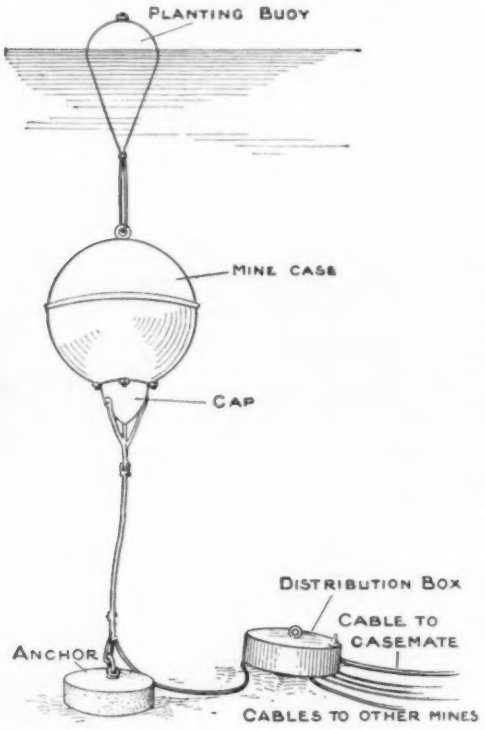
A new electric safety lamp for miners, the chief feature of which is the fact that it is both an electric and an oil lamp, has just been placed on the market in England. The electric part consists of a metallic-filament lamp placed in front of a strong reflector, and operated from a 4-volt cell contained at the base.

At the back of the electric lamp is a small oil lamp, protected with a glass shield and a piece of gauze. A switch is arranged whereby the light from the electric lamp can be turned off, which action simultaneously passes a current through a platinum wire, by means of which the oil lamp is ignited. In order to prevent both oil lamp and electric light glowing at the same time, a snuffer over the oil lamp is brought into action when the electric light is turned on.

The lamp weighs a couple of pounds and will burn for an 8-hr. shift. The oil lamp, with its covering of gauze, is intended for testing gas.

AMERICAN SUBMARINE MINE

The type of submarine mine planted by the U. S. coast artillery corps for blowing up the vessels of the enemy in



times of war is shown in this drawing. At the present time, ships known as mine-planters, with detachments of troops on board, are busy planting such mines for practice purposes.

The drawing gives an excellent idea of the mechanism of such a mine and its manner of discharge by electric current from the shore. The buoy rising above the surface of the water is used to mark the mines.

POLISH FOR CONCRETE FLOORS

A waxy substance of different colors, mined in Germany, and known as "ozokerite," is being used as a polish for concrete floors. Spread on the surface to be coated, it is ironed in with hot irons, and gives a smooth and durable face that can easily be cleaned. Ink, or other stains, spilt on the wax can be wiped with a rag and leaves no stain.

Very little of the substance has yet been received in the United States, but it is now being tried on both the walls and floors of the hospitals in Manila, as it is claimed to afford no holding for dust or germs.

ACTIVITY WITH ARMY AEROPLANE

Starting Oct. 8, and ending Nov. 9, through a slight accident to the right wing and the skid of the machine, the army aerial corps made 71 flights, the longest of which was 61 minutes. The officers making the flights were Lieut. Lahm, Capt. Chandler, Lieut. Humphreys, Lieut. Foulois, and Lieut. Sweet.

The rapidity with which an aviator can become proficient is illustrated by the flights of Lieut. Humphreys. Beginning with a flight of 3 minutes, he followed by a flight of 8½ min., then by one of 24 min., then took up Lieut. Foulois in a flight of 61 min.

The next longest flight was made by Lieut. Lahm, and covered a period of 58½ min.

HOW TO MAKE A SIDE CHAIR

A side chair of simple design and construction is here given. The great difficulty with most chair designs is that the back is generally designed narrower than the front, thus necessitating the rails entering the posts or legs at angles. To the amateur this is quite confusing. The chair illustrated is the same in width, both back and front, so that the shoulders of all the rails are at right angles to the sides. The back of the chair is straight, thus simplifying the design still more.

Another thing which is confusing to the beginner in his efforts to lay out the mortises is the irregular placing of the rails. It will be noted that in this design the rails of side, front and back are on the same level.

Plain sawed red oak will be appropriate for this piece. Have the pieces

mill-planed and sandpapered on four sides to size, allowing ½ in. extra to the lengths for squaring up the ends.

There will be needed the following:

4 rails, ⅞ by 2 by 17½ in.
4 rails, ¾ by 2 by 17½ in.
2 front posts, 1½ by 1½ by 19 in.
2 rear posts, 1½ by 1½ by 37½ in.
1 back, ¾ by 9¾ by 17½ in.
2 cleats, ¾ by 1 by 16 in.
4 slats, ¾ by 2 by 16½ in.

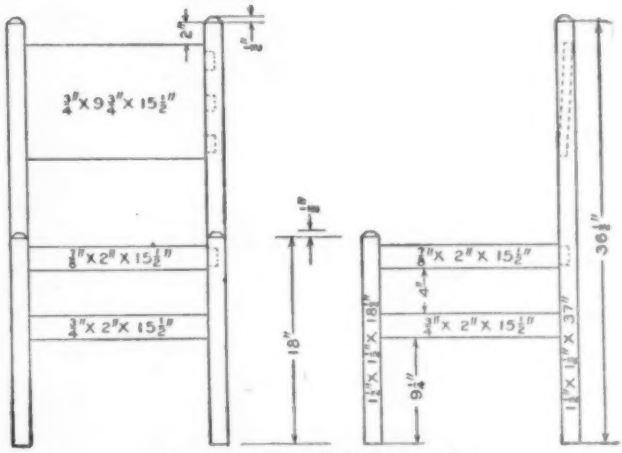
Begin work by cutting the posts to the lengths indicated in the drawing. The lower ends should be chamfered slightly to prevent their splintering from usage. The top ends are cut to an angle of 45 deg., the slope beginning ½ in. below the top. Lay out and cut the mortises. To do this, lay off the measurements on one of the posts then place all four side by side on the bench, with the face marks up. Even the ends with the trysquare and then carry the measurements just made across all of them, using the trysquare. The rails ought to be shouldered on all four sides. Three-eighths inch is a good thickness for the tenons. The width may be 1¼ in. and the length 1 in.

Place the rails side by side on the bench with the joint-edges up and the ends evened. Measure off the desired length on one of them and carry the lines across all of them to indicate the location of the shoulder lines. Separate the pieces and square these lines entirely around all of the sides of each piece. With the tenon saw rip and cross cut to these lines.

The back, it will be noted, is set on a slant to add comfort. Thoroughly clean all the parts and assemble them, using good hot glue. Put the back together first, then the front. After these have dried, put the side rails in place.

Cut and fit the two cleats —one to the front rail and one to the rear rail. Keep them even with the lower edge of the rail so as to form a slight recess at the top when the slats are in place. This is to keep the cushion from sliding off. The slats need not be "let into" the cleats but merely fastened to their top edges. The cushion may be made of Spanish roan skin and should be filled with elastic felt.

Side Chair Complete



Details of Side Chair Construction

In the chair shown, the joints are reinforced by the addition of lag screws. If the glue is good and the joints well fitted, these are not necessary.

SANTOS-DUMONT WORKS LEVER WITH HIS BACK

The little fixture shown attached to the back of Santos-Dumont's coat in

Santos Dumont's Third Hand

this photograph is the unique and effectual means he utilizes to work the warping lever of his little aeroplane "Demoiselle." By leaning sideways in one direction he warps one plane, and a like movement in the other direction warps the other. The extent of the warping is determined by the distance and direction he sways his body, and the very novel idea works to perfection. It practically gives him a third hand in the middle of his back.

GAS WELL THAT WILL NOT BURN

A gas well has been struck near Minot, North Dakota, which to all intents and purposes comes under the head of a "wind" well, the most famous previous example of which is located at Dexter, Kansas. The well was sunk to a depth of 216 ft., and, under mercury gauge test, gave an output slightly over 4,000,000 cu. ft. per 24 hours. Plans were then made for a considerable celebration, and announcement was made that the gas would be lighted at a certain time.

On the day in question an immense crowd gathered, only to be disappointed. Time after time the company's employes tried to light the gas without success, while the spectators watched and wondered. An analysis was subsequently made, and the gas was proved to be nearly pure nitrogen.

The experience is not an unusual one, according to drillers. Somewhere in every gas field a pocket of non-combustible gas is discovered. The only inflammable substance that will continue to burn in such a well is said to be phosphorus.

A BOOK LOUDER THAN "THREE WEEKS"

Ever since Elinor Glyn's book, "Three Weeks," was given to the public to play with, many publishers have vied with each other to produce a still "louder" book, but the loudest has just been placed on the market by a unique book publisher never before heard of in the publishing line.

It is finely bound in cloth-board covers, and bears the title "Four Weeks." Beneath the title is a handsome picture and the frank announcement that it is "A Loud Book." Placed on a table

A "Loud" Book

among other books it draws instant attention, either for the purpose of read-

ing or throwing out, but the opening of the cover explodes a cap that sounds like a small cannon. It is set for the next victim by pushing a piece of tape a little further along, 50 caps being provided with each book.

PHYSICIAN HOLDS BREATH NINE MINUTES

Attention was drawn some time ago in this magazine to English experiments with oxygen as a means of developing additional energy in athletes just before taking part in races or games. In a recent experiment, conducted at the medical school of the London hospital, one of the doctors, after breathing oxygen out of a bag for five minutes, was able to hold his breath 9 min. 3 sec., which seems an extraordinary feat.

From the above test, and others of almost as long duration without breathing, Dr. Leonard Hill concludes that by taking oxygen before a quarter-mile race an athlete ought to be able to hold

Breathing Oxygen from a Bag

his breath during the whole race, and devote the energy thus saved to faster running.

The second International congress of refrigeration will convene in Vienna, Sept. 29—Oct. 3, 1910.

MESSENGER GIRLS IN BERLIN

When Paris turned out a corps of women bill-posters many people wondered what would come next, and they

German Messenger Girl

had reason to wonder, for now Berlin has come forward with girls to do the work in that city similar to the mission of the A. D. T. messenger boys in America. They wear the uniforms shown in the illustration, ride diamond frame bicycles, and are called to fetch and carry bundles and messages.

They are also fully qualified cooks, and the housewife whose cook has left suddenly has only to send for one of them and her difficulty is solved. They cook for so much an hour, and for this purpose, at least, are far superior to the messenger boy.

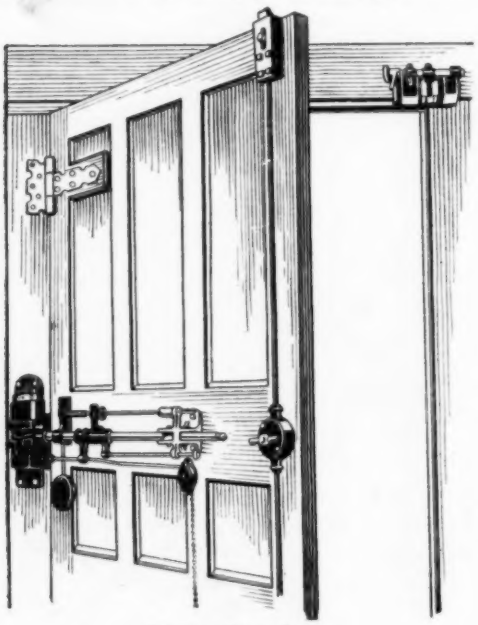
CAUSES DEAD DOG TO BARK

An interesting demonstration, in which a dead dog was made to bark by the application of a feeble electric current to certain muscles of the throat after the lungs had been artificially inflated, took place recently before the French academy of sciences. Howls were produced by multiplying the experiment.

The scientist deduces from his experiment that the so-called loss of voice by singers may be counteracted by electricity applied to restore muscular activity to the larynx.

ELECTRIC DEVICE TO OPEN AND CLOSE DOORS

An electric device that will open or close doors by simply touching a button, and which can be automatically set to close doors at any desired time, has been designed especially for fire stations. The illustration shows a door so equipped in one of the fire stations of Portland, Maine. When an alarm of fire is turned in, the pressure of a finger on an electric button throws the door open. At a predetermined time after the button is pressed, the door automatically closes, a sufficient lapse of time being allowed, of course, to make sure that the fire apparatus has passed through.



Electric Door Opener

The invention has been applied successfully to nearly all of the fire houses in Portland.

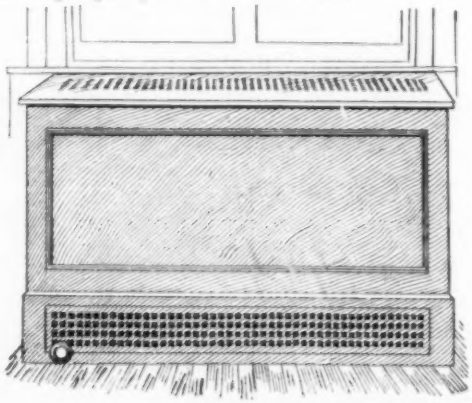
THE SHIP SUBSIDY QUESTION

Brainy men of the country who are studying the ship subsidy question believe the new steamship lines, carrying the American flag into foreign ports, would increase American trade in countries which today patronize American merchants and manufacturers only slightly, if at all. Also that the expenditure of $10,000,000 in subsidies by the government would result in the building of $25,000,000 worth of vessels in American shipyards, and an increase in yearly exports of $200,000,000 or more.

"The only plan which commends itself to me," said President Taft while on the Pacific coast, "is to give enough money to the merchants engaging in this trade to enable them to meet the difference they encounter in competition with foreign ships. A mail subsidy can be used for the purpose of experiment, and if it proves a failure, then the money will be well spent for having taught us a lesson."

RADIATORS UNDER WINDOW SEATS

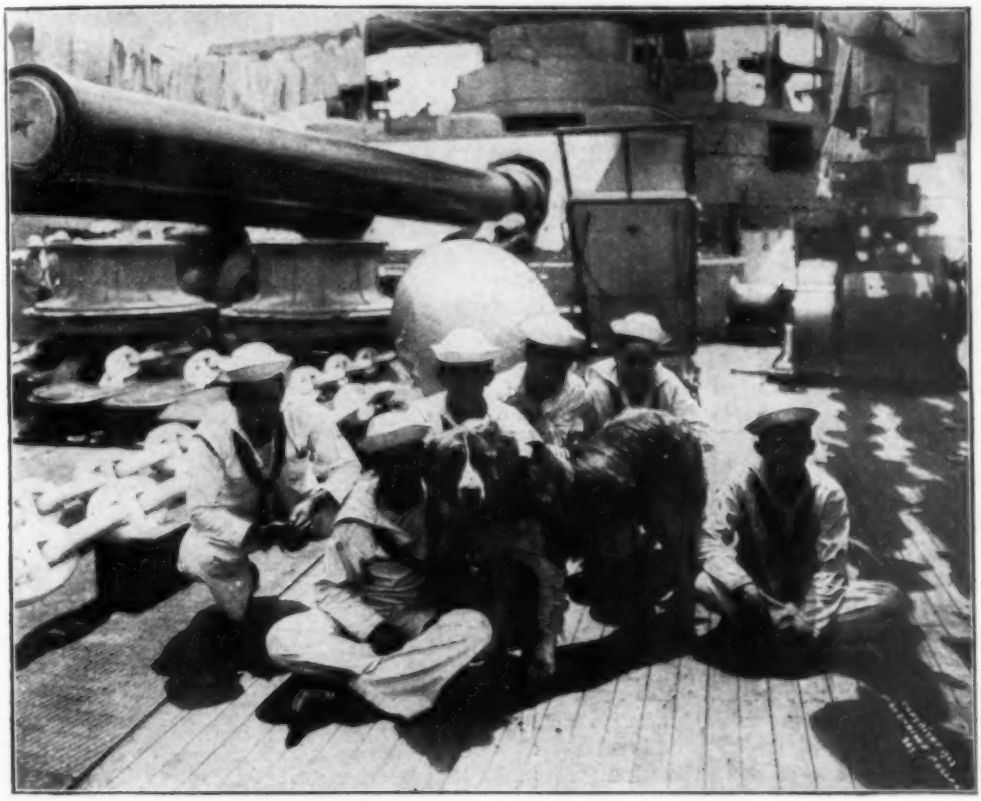
The radiators in all the principal rooms of the new 8-story town house of J. H. Iselin in New York are located under window seats, which have removable registers. The idea is artistic as well as unique, forming a cover for a necessity which can very seldom be made otherwise than a blot to the general beauty of a tastily decorated and properly furnished room.



Courtesy Domestic Engineering

Radiator in Box Window Seat

The removable gratings make the removal of dust an easy task, and in case of repairs, furnish quick access to the valves.



LIFE IN OUR NAVY—No. 7, Mascot on the "Vermont"

WAR VESSELS ON THE GREAT LAKES

The number of war vessels to be maintained on the Great Lakes is a problem which may become acute at any time and require the serious consideration of this government. It is one of the matters which is likely to confront Secretary Knox and require some clever handling if he remain at the head of the department of state for any considerable length of time.

Indications are becoming strong that Canada and Great Britain are concerned over the situation. An understanding known as the Rush-Bagot convention exists between the United States and Great Britain limiting the number of vessels on the Great Lakes. It has existed since 1817 and provides that no vessel is to exceed 100 tons, that the armament of each is not to exceed one 18-lb. gun, and that each country have not more than two such vessels on the upper lakes, one on Ontario and one on Lake Champlain.

Canada now has but one war vessel on all the Great Lakes, and this is said to be unarmed, while the United States has six armed vessels and three disarmed. Altogether these have more than 50 guns, with a force of about 2,000 men. So far as conditions are today, in case of a sudden row, the United States could absolutely dominate the Great Lakes.

It is said the increase of American vessels is due to the shipbuilding activity on the lakes, and the desire of the companies to have part in naval construction. Back in 1890, the two nations were near an agreement by

which unequipped war vessels, built in American yards on the Lakes, were to be allowed to go through the Canadian canals, and thus get to sea. This fell through.

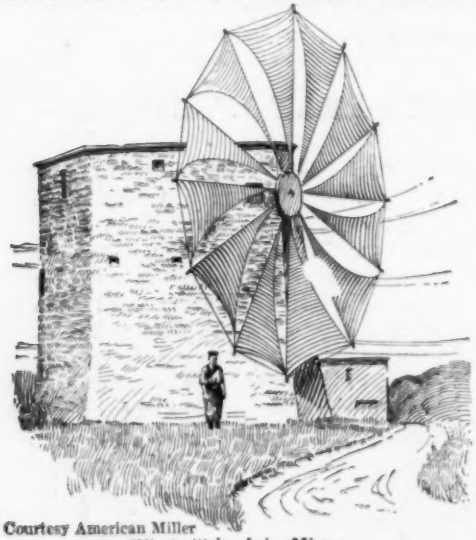
Canada has sought to keep up the agreement in order to avoid going to expense for a navy. She has not insisted very rigidly on the agreement in order not to provoke a controversy which would end in the United States terminating the agreement. Americans have taken the view they ought to have vessels on the Lakes for the reason that in case of war plenty of light draft, British vessels could get through the Canadian canals.

The movement for stronger naval defense in Canada is gaining ground, being a part of the general movement for defense of the Empire, and this has stirred up more or less anxiety in Canada on account of the situation on the Lakes.

Canada and Great Britain are beginning to talk of ending the old convention of 1817, or of changing its terms so as to arrive at some new understanding. It is pointed out that if the United States gets a Lakes-to-the-Gulf waterway, then it will have no further use for the Canadian canals. It is thought possible in Washington that this idea is in the minds of the Canadians and British and they want to conclude a convention on new terms before the waterway in question is decided on.

TURKISH WINDMILLS

Holland is known to all the world as the land of windmills, but very few people know that the windmill did not belong to Europe in the first place, but was borrowed from the Saracens. There is, it is believed, no instance of a windmill being used in Europe until the time of the Crusades. The illustration shows a typical wind-driven flour mill in Asia Minor. The planes of the wind-wheel are apparently made of a fabric, and catch the wind as do the stay-sails of a sailing ship.



Courtesy American Miller
Windmill in Asia Minor

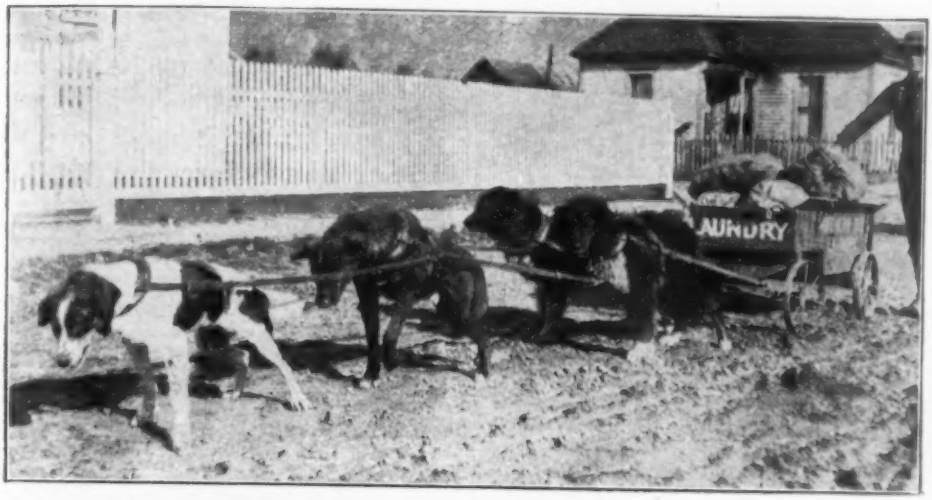
A HUMAN OSTRICH

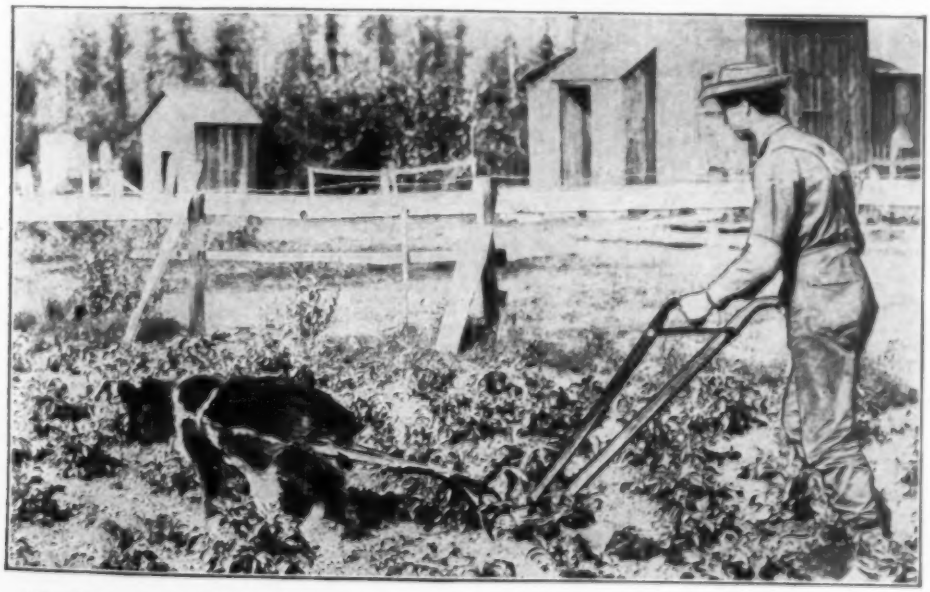
An autopsy performed on a patient who died at the Philadelphia hospital after suffering with a malady the physicians could not define, disclosed that his stomach contained a can opener, trunk key, wire nails, safety pins, and several links of a cup chain. The man had been an electrician, and was committed to the care of the hospital because of erratic behavior.

ALASKAN DOGS ON ROAD AND FARM

The world has become so familiar with the dog teams of the northern regions that the fact that the dogs can be used for other purposes than the drawing of sleds over snow or ice-covered trails is forgotten.

These illustrations show a team of Alaskan dogs drawing a sled at Valdez in the winter time, and the same dogs doing farm work in the short summer months. The machine used in the cultivation of the potato patch is a small wheeled hoe, and the one dog draws it easily. The small wagon marked "laundry" and drawn by four dogs, is loaded with nearly 1,000 lb. of potatoes being taken from the field to the storeroom.—Photographs by Owen Meals, Valdez, Alaska.





Drawing a Potato Wagon in Summer Time—Sled-Team of Alaskan Dogs—Cultivating Potatoes

JAPANESE MINSTRELS IN DISGUISE

The wandering minstrel shown in the illustration wears this peculiar head-dress from a sense of shame. He is one of the Komuso gentlefolk reduced to becoming wandering minstrels to earn a living. The head-dress, for hat it cannot be called, is shaped something like an American half-bushel basket, but it is of very light wicker, and has a series of grate-like openings through which the wearer can see. The openings are made by eliminating every other strand in the weaving.

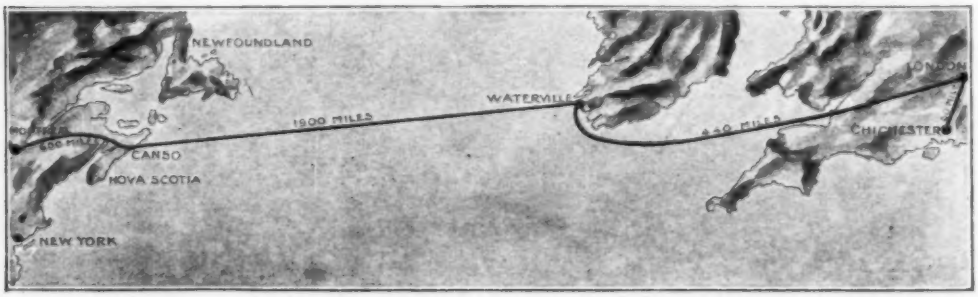
PUSH BUTTON UNDER DINING ROOM RUG

To avoid cutting holes in valuable dining room rugs in order to use a push button for calling the waitress to the table, a special device has been invented. Instead of a button, two thin flat contact plates, separated slightly, and about four inches in diameter, are connected to the wires. This is placed under the rug at any point most conveniently reached by the hostess with her foot. It is so thin and flat the shape does not show through the rug, and yet a gentle foot pressure on the rug over the signal will make contact and ring the bell in kitchen or butler's pantry. The caller should be put in with wires of sufficient length to reach to any seat at table which the hostess might occupy.

KING OPENS TUBERCULOSIS INSTITUTE BY CABLE

It oftens occurs that a great undertaking is opened by a noted man by telegraph from a distance, the last important instance in this country being the opening of the Alaska-Yukon-Pacific exposition by President Taft. But the first instance, or at least the only one this magazine is at present familiar with, of opening an undertaking by cable from across an ocean, occurred in October when King Edward of England opened the Royal Edward institute in Montreal. The institute is for the study and cure of tuberculosis.

At 9 o'clock in the evening at West Dean park, Chichester, England, which was 4 o'clock the preceding afternoon in Montreal, King Edward pressed a key which sent a flash of electricity over 3,000 miles of wire and cable to a mechanism that opened the doors of the institute, turned on the electric lights, and hoisted the Union Jack.



The Course of the Electric Energy

THE BEST VENTILATED HOUSE IN THE WORLD

By C. H. Claudy

Proper ventilation is the foundation of health of lung. But the best ventilated house of which you have ever heard is but poorly supplied with air beside the residence of T. C. Northcott, Luray, Page County, Virginia, and he and his family are further from any bodily ailment caused or fostered by poor air than any one else in the world save, perhaps, the dweller in a hut on a mountain top.

For "Limair," as this home is called, is built on the top of a hill in which are the wonderful and beautiful caverns of Luray, renowned the world over as being the most beautiful of those underground habitations of the Nibelungs of old, which Nature has provided for the wonderment of those who discover them, and the visitors who come after. Not by any means the largest caverns —the Mammoth cave in Kentucky has that distinction—the Luray caverns are so hung and festooned and draped and decorated with rock formations fantastic and beautiful, as to leave the beholder breathless from admiration and awe. No other caverns have the wealth of decoration which has been here provided. It is as if Nature made these caverns first, to show what she could do in stalactite and stalagmite formation, and then tiring, gave to other caverns only a portion of her wonderful handiwork.

Titania's Veil in One of the Luray Caverns

But, you will want to know, what has the location of a home on the top of a hill in which is a cavern, no matter how beautiful, to do with its ventilation? And what has the relative beauty

to do with the matter, anyway? The answer is in the connection of the cave and the house. Mr. Northcott is a retired heating and ventilating engineer, and it was while pursuing his avocation that the advantages of cave air for human breathing were studied. When he was able to get control of these caverns, which he finally purchased, he immediately erected his house, in which he has embodied some unique ideas. A shaft has been sunk through the hill to the caverns, and by means of an electric fan air is sucked from them to be pumped into the house at the rate of 8,000 cu. ft. a minute—enough to change the air in every room in the house every four minutes!

The advantages, not apparent on first sight, are nevertheless both great and striking. Cave air—particularly lime-cave air—is germless. And here is where the beauty factor comes in—that cave is most beautiful and has the most beautiful formations, the roof and the earth above the roof of which contain the most lime, since it is largely by the action of seeping rain water, which readily dissolves lime, that the formations are made. And the more lime in the earth through which air as well as water percolates, the better filtered will the air be, the less germs and dust it will contain, and the more healthful it will be to breathe.

"Limair" is a house without dust and without germs. Never a window is opened in "Limair" save for cleaning, for the ventilators which admit and remove air in all the rooms deliver more and sweeter air for breathing than all the windows could do. The air which comes from the cave is dustless, so that the only dust which ever enters "Limair" comes with people or from open doors.

But germlessness and dustlessness are not the only advantages of this idea. The temperature of the caverns fluctuates but two degrees during the year—from 54° to 56° F. So that, to heat the house in winter, it is required to raise the temperature of the air but 14 to 16 degrees. And in summer time, when other people try to cool their houses, this house has sometimes to be warmed. On the hottest day—and 100° F. in the shade is not uncommon in Virginia—"Limair" is cool and comfortable. An open fire burns in the living room on the hottest of evenings. It is very possible to make "Limair" uncomfortably cool in summer by transferring to it air from the cave without any preliminary warming.

Dustless, germless, even temperature—it would seem that the limit of ventilation perfection had been reached, but there is one thing more—humidity. We suffer from an excess of humidity, even if the temperature is not great. Those are the days when every move brings out the perspiration and we are damp, even if we take no exercise. As a matter of fact, we do not exude any more moisture than usual, but, with a high degree humidity, the already overladen air refuses to take up any more. On very dry days, we are less uncomfortable, but we and our possessions

Air Duct from Shaft House to Limair

Copyright, J. D. Strickler

alike suffer from lack of moisture in the air. In "Limair," the humidity, like the temperature, is always normal and always the same. Humidity is expressed in percentage of the possible amount of moisture which the air at any one temperature can take up. At one temperature air will always saturate with a certain given amount of moisture—no more and no less. But change the temperature, and it either precipitates moisture (the familiar rain, snow and dew are examples) or makes it possible for the air to take up more water.

The normal humidity of the cavern air is 87 per cent at a temperature of 54° F. When this temperature is raised, the humidity is lowered, so that when the temperature is 70° F. the humidity is 70 per cent, which is the normal amount desired and required by the human living machine.

The air, after it comes up the shaft from the cave—from a portion away off from the regular route of the visitor—is sent through a passageway or duct to the house. This duct is double, and the air may be sent next a tin roof, in summer or winter, for warming by the sun, or through the lower wooden portion, to gain the rooms cool and moist. But it does not go direct to the house from this hundred-foot passageway, but to a plenum chamber in the basement, from whence it passes to distributing chambers, in winter over steam coils for heating, and thence through a double flue to every room in the house. The inside flue takes in and distributes the good fresh air—the outside, with an entrance from the room at the bottom, removes and carries off the air which has been breathed. All these out-draft flues gather in the attic at the top of the house, from whence the used air is discharged into the outside atmosphere again.

The economic importance of this matter is not limited to the few fortunate people who can buy caves and erect houses connected to them with shafts and electric fans. The advantages of germless and pure air are universally recognized in the treatment of lung disease. Hence the exodus of hopeful consumptives to Colorado, the Alps, and high places generally, where the air is pure and free from dust. But even mountain air may be germ laden. Lime-cave-filtered air is not.

Copyright, J. D. Strickler

The Saracen's Tent

Yet, if this is so, why not take up a residence in a cave and thus cure consumption? For the very good reason that while germless air is balm for

wounded lungs, damp air and lack of sunlight are so many barbs to make new wounds. Consumptives have tried living in caves before now, and paid the penalty with their lives.

But, to carry the good air into a house, decrease its humidity or dampness to the proper percentage, and provide a sun parlor in which patients can get the beneficent rays of the great orb of life at the same time breathe only air which is purer far than that filtered into the finest of operating rooms in the best equipped hospitals—that is the ideal for the lung trouble patient. Mr. Northcott has built his house, proved his theory, and lived there in comfort for years. His family doesn't know what it is to have a cold. The most stubborn cold yields to a night or two in the house, in the case of a visitor. To live there is to be full of energy which comes from pure oxygen.

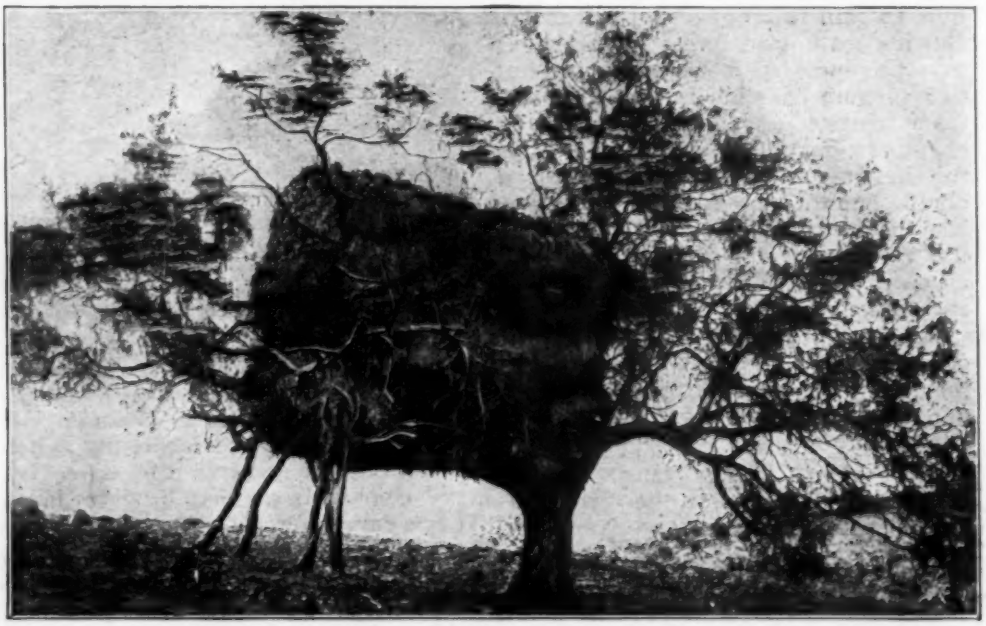
To look into the future is given to no one, but it hardly needs any gift of prophecy to see that some day the lime caverns of the world will be each surmounted with a sanatorium for the treatment of lung diseases, and hospitals especially for operations under absolutely aseptic conditions.

STORING FODDER IN TREES

The trees in the mountains of the state of Oaxaca, Mexico, are put to a novel use following harvest time. After the ears of corn are taken from the stalks, the remaining corn fodder, or "zacate" in Mexican, is stored in the trees by being stacked either on the branches in the center of the tree, or on limbs, supported by props, as shown in the illustration. At this elevation the animals cannot reach it, and it remains safe until needed for fodder, without the necessity of building fences around it.

THE NEW 14-IN. GUN

The largest and most powerful naval weapon in the world—a 14-in. breech-loading gun, has been recently com-



Storing Fodder in Mexico

pleted for the U. S. navy by a Pennsylvania steel company. The great gun, which was conceived for the American 26,000-ton "Dreadnoughts," weighs 63.3 tons, or 10 tons more than the guns of the "North Dakota" and "Delaware," and is about 6 tons heavier than the 50-caliber 12-in. guns intended for the "Arkansas" and "Wyoming."

The total length of the gun is 53½ ft., and the capacity of its chamber is 15,843 cu. in. It is in this chamber that the charge of 365 lb. of smokeless powder will be placed to discharge the 1,400-lb. projectile the gun is destined to fire. After the shell is fired it will travel a distance of 542 in. within the bore of the gun, and the rifling will impart a rotary motion which will prevent the projectile from turning on end and losing its force.

The extreme range of the gun is expected to be more than 25 miles, and the range at which it will be fired in actual battle will be about 9,000 yd., or 5 miles. At the time of the Spanish-American war the range of big guns in battle was only 3,000 yd.

The 1,400-lb. projectile will leave the gun at a speed of 2,600 ft. per minute, and its muzzle energy will be 65,606 foot tons. After traveling a distance of 3,000 yd. the projectile will still retain a velocity of 2,234 ft. per second, which will enable it to pierce at that distance a thickness of 18.7 in. of Krupp steel armor. At the extreme battle range of 9,000 yd. the armor it can pierce will be about 11 in. thick.

WASHINGTON'S FACE DISCOVERED IN ROCK

Many rocks have become famous because their outlines resemble the profiles of historic men, but none are more perfect than this George Washington rock discovered near South Bethlehem, Pa., during the clearing away of the side of a mountain for park purposes last summer. Viewed in profile, the nose, upper lip, eye, and chin, are as clearly defined as though cut by human agency. Even the rock formation of the head has a surface curiously like in appearance to the wigs worn in colonial days.

Nature's Tribute to George Washington

ZEBU STEAKS PLEASE PARISIAN PALATES

Paris has regaled itself on the steaks, roasts, and stews of a dozen carcasses of the zebu, and having pronounced the meat as excellent as that of the highest grades of cattle, the French colonial authorities are to make a serious attempt to introduce such a diet into France. The first lot sold in the Paris stalls brought the prices of the highest grades of beef, and consequently the government of Madagascar is enthusiastic.

The zebu, which is likewise known as the Indian ox, is not unlike the familiarly known breeds of cattle in America, and its meat is described as savory and nutritious. The male zebu is regarded as sacred in some parts of Asia and Africa.

Bismarck Monument at Frankfort-on-the-Main

GERMAN AERONAUTS MEET DEATH

Dr. Brenckmann and Hugo Francke, two of the best known members of the Berlin aero club, lost their lives last November through the collapse of their balloon "Kolmar" in Austria-Hungary. They had flown a distance of 500 miles in a direct line south when the accident occurred. The mangled remains were found on the ground, and nearby was the balloon, a huge rent in the envelope revealing the cause of their death.

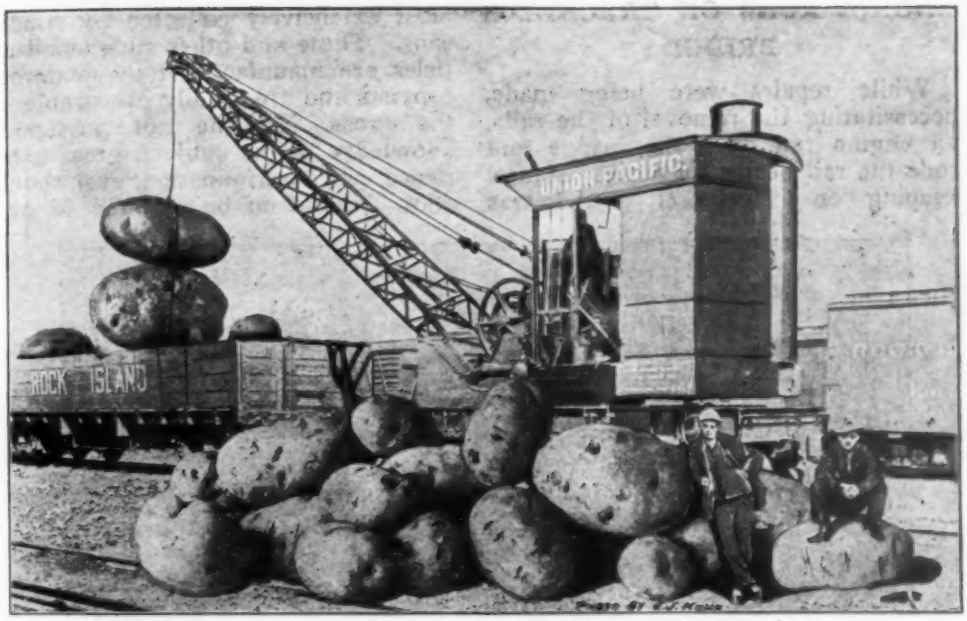
Brenckmann was the third person to insure his life in the newly-formed German insurance company which takes aerial-navigation risks.

FUNERAL PROCESSION IN SURINAM

The native funeral cortéges of the dead in Surinam, Dutch Guiana, are made an imposing and somewhat curious sight by reason of the custom of proceeding on foot, clothed in white costumes, which is the reverse of custom in the majority of countries.

The coffin, draped in a white cotton sheet, is borne on the shoulders of six bearers dressed in white and wearing black top-hats. The mourners, also dressed in white cotton robes and headdress march behind. It is considered great disrespect to the dead to stop and rest on the road to the cemetery, hence six additional bearers march beside the coffin to relieve the first six when they become tired. The figure in black at the head of the cortége performs the last religious rites at the grave.

Funeral Cortége in Dutch Guiana



Loading Mammoth "Spuds" in the State of Washington

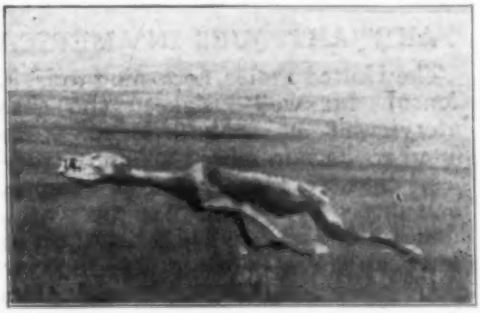
6,000-MILE JOURNEY ON MOTORCYCLE

A transcontinental journey on a motorcycle, full of remarkable experiences and hardships, has just been completed. Herbert F. Meriwether, of San Francisco, rode into New York in excellent health despite his strenuous accomplishment.

The distance traveled was more than 6,000 miles, over 2,000 of which were across ties on railroad rights-of-way, through mountains and districts where country roads were absent, or impassable for such a machine. The route lay from San Francisco through the valley to Los Angeles, then across the Mojave desert and over the border into Mexico. Here trouble began. The natives were unfriendly, even refusing food and drink. Sand storms had to be fought, and not finding a passage through the mountains, Meriwether had to return to Los Angeles and start again. His final route led him through Arizona, New Mexico, Texas, Louisiana, Mississippi, Tennessee, Kentucky, Ohio, West Virginia, Pennsylvania, and New Jersey.

A STARTLING APPARITION

These mummified remains of an animal in a field in California provide a startling apparition on moonlight nights, especially to those who view it for the first time. Its apparent galloping through space at a speed impossible to earthly racers is caused by the manner of its suspension from a wire, which is but dimly seen in the illustration and is not at all visible at night. The outstretched neck and backward

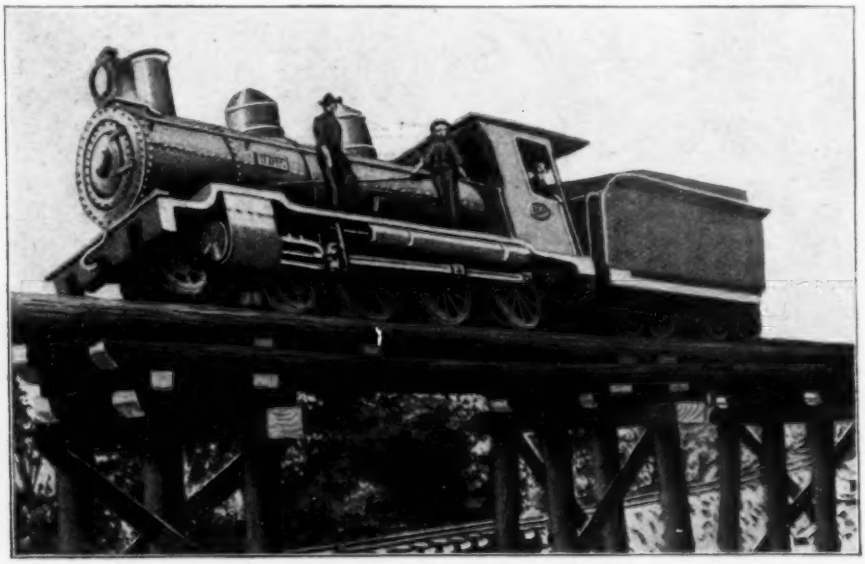


Ghostly Courier of the Plains

bent limbs certainly convey the idea of speed, and the gleaming fangs, or teeth, carry out the grewsome impression.

ENGINE RUNS ON TRACKLESS BRIDGE

While repairs were being made, necessitating the removal of the rails, an engine ran onto the bridge and rode the rail beams for some distance, keeping "on a level keel" until it was stopped. The curious accident occurred near Zillmere, Australia, and, although no one was injured, traffic was blocked for several days, the task of rescuing the engine from the bridge proving difficult.



On a Bridge without Rails

"FAKE" ANTIQUES IN AMERICA

The United States, according to U. S. Consul Maxwell Blake, who has interviewed the well informed, is reputed to harbor more "artistic atrocities," that were purchased as genuine, than any other country in the world. That the flux of pseudo works of art to American shores will continue to grow even greater is also expected, unless these frauds are detected by government experts or rejected by public taste.

Just at present miniatures and decorated snuff and match boxes are being most extensively collected by Americans. These and other such small articles are manufactured by dexterous copyists and are readily procurable by the gross. No one not possessing knowledge of the subject, great experience, and discrimination, ever should allow himself to be tempted to purchase such articles unless he is content to possess a cabinet of forgeries.

Color prints are almost as difficult to judge as miniatures and snuff boxes, since in the past they have been very legitimately, and sometimes very beautifully, copied. But many of these fine productions, which originally were only intended as such, have been converted into "antiques," to be sold to the inexperienced at high prices.

The collection of china, likewise, must inevitably lead the novice to even more hopeless plight. Genuine examples of Dresden, Chelsea, Worcester, or Bow, are worth more than their weight in gold; yet what one may fondly imagine to be a convincing piece, with its refined decoration and simple gilding, bearing the golden anchor, is not a bit of old Chelsea, but a fake made by well-known firms on the Continent. Only the uninitiated now

put reliance in "old marks." They are meaningless, and are freely applied to modern copies with open and notorious forgery.

Antique furniture was dealt with exhaustively in a past issue of this magazine, and the industry offers the greatest pitfalls for the lovers of things old. In Holland old chests, cabinets, desks, and chairs of little value are collected, and, after being veneered with cheaply made marquetry, are sent to Great Britain. Old oak beams from demolished churches or granaries are likewise in constant demand for conversion into Jacobean refractory tables and Queen Anne furniture. Grandfather clocks are frequently made up of such incongruities as a modern dial with a forged maker's name and date, and an old case patched up and set off by modern inlay.

Violins signed Stradivarius, surreptitiously hidden in rubbish heaps, are replaced by others as soon as sold. To successfully collect anything "antique" nowadays requires expert knowledge and technical training, as nothing but the veriest trash is to be found in 90 per cent. of the antique shops of Great Britain and the Continent.

"Those, therefore, who wish to secure genuine antiques," says Maxwell Blake, "would better make up their minds that it will be more satisfactory, and cheaper in the end, to purchase only on expert advice, or of dealers willing to give a written stipulation that all articles sold are guaranteed to be approximately of the period represented."

MADRONE TREE GROWS FROM REDWOOD STUMP

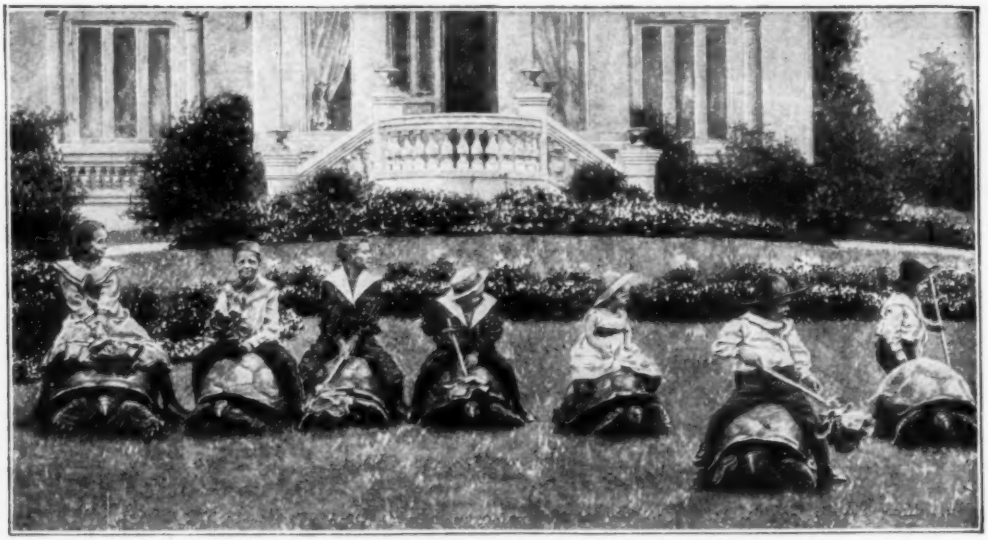
The tree shown in this photograph is a madrone growing 5 ft. from the ground up, but that 5 ft. is a redwood stump about 3 ft. in diameter. The madrone trunk is about 7 in. in diameter and 15 ft. high. Presumably its seed was blown into a cavity or core in the redwood stump, this probably extending into the ground, thus giving the roots of the madrone a chance to reach earth. The redwood stump is now showing signs of splitting, due to the growth of the intruder.

An Interesting Tree Growth

ELECTRIFICATION OF CITY TERMINALS

In direct opposition to the stand taken by railroad executives who are fighting the attempts made by Chicago and several other cities to compel the electrification of the roads within the city limits, the engineers who have been engaged in the electrification of railroads in New York insist that the expense of steam locomotives is the greatest.

That electrification has increased the capacity of the New York terminal of the New York Central road one third and that important savings have been effected in almost every department of operation, is the testimony of W. J. Wilgus, who was in charge of the work.



Children on Turtle Steeds

TURTLE RIDING IN GERMANY

The curious scene shown in this illustration was photographed in the garden of an estate in Germany. The owner of the estate is a lover of children, and one of the amusements he provides for them is riding turtle-back on real live turtles. Racing on such animals may not be quite as exciting as automobile or aeroplane races, but the finish is just as doubtful.

A BOMB BURST BY ICE

[An interesting experiment conducted by T. R. Clapham, F. R. A. S. of Austwick Hall, Lancaster, England, is described in the accompanying article. Some time after the experiment Mr. Clapham died, and the article in question, addressed to Popular Mechanics, was found in his desk.—Editor's Note.]

Result of Ice Explosion

The bomb used was 8 in. in diameter, and of iron 1½ in. thick. In it was placed about 45 fluid ounces of water, and an iron plug was firmly screwed into the hole to act as time fuse. The bomb was then placed in a bucket containing 20 lb. of snow and 10 lb. of salt. In 78 min. (your scientist is a patient man) the water in the bowl was converted into solid ice, and the iron was burst by the sudden expansion. About 230 tons internal pressure, Mr. Clapham estimated, must have been exerted to accomplish the result.

The three pieces of the burst bomb are shown in the illustration.

FRENCH AERONAUT ADMITS FRIGHT IN AEROPLANE

Professional aeronauts and even amateurs in the art of guiding aeroplanes have heretofore always gone into ecstasies when inquiry was made as to their sensations when gliding through the air. But Count De Lambert, one of the most expert operators of aeroplanes, and the inventor of a notable one, gives quite a different version of it. "There is no 'heavenly rest' about it," he says and he ought to know.

He is the first to describe the sensation as anything but delightful. He has made hundreds of flights, and is, withal, considered a man of excep-

tional courage. Professional aeronauts are not, as a rule, given to talking about their sensations. The Wright brothers have not, as yet, been induced to talk at any length on the subject. Describing his feelings when he was several yards above the Eiffel tower, Count De Lambert says:

"I wanted to keep my aeroplane from rising higher, but was unable to do so. For at least ten minutes I was absolutely helpless. I could neither move nor stir. For a brief space of time I seemed to see thousands of candles dancing before my eyes. It was a case of sheer fright."

A REMARKABLE VOYAGE

In the early part of November the trading schooner "Silver Wave," arrived at Port Townsend, Wash., from Nome, a passage of 2,500 miles, after a 22-days' voyage under conditions somewhat extraordinary. Sailing from Nome at a season of the year rated as dangerous for the largest ocean-going vessel, the little schooner navigated the long passage with only one experienced sailor in its crew, and without other navigating instruments than an old compass and a chart made in 1806. The latter was so worn by constant use, and so lacking in desired information as to be almost wholly useless.

Gales that taxed the endurance of large steamships were encountered all the way down the coast, but despite the many difficulties, land was picked up off Cape Flattery only a few miles off what would have been a precise course.

Relic of Pioneer Days in the West

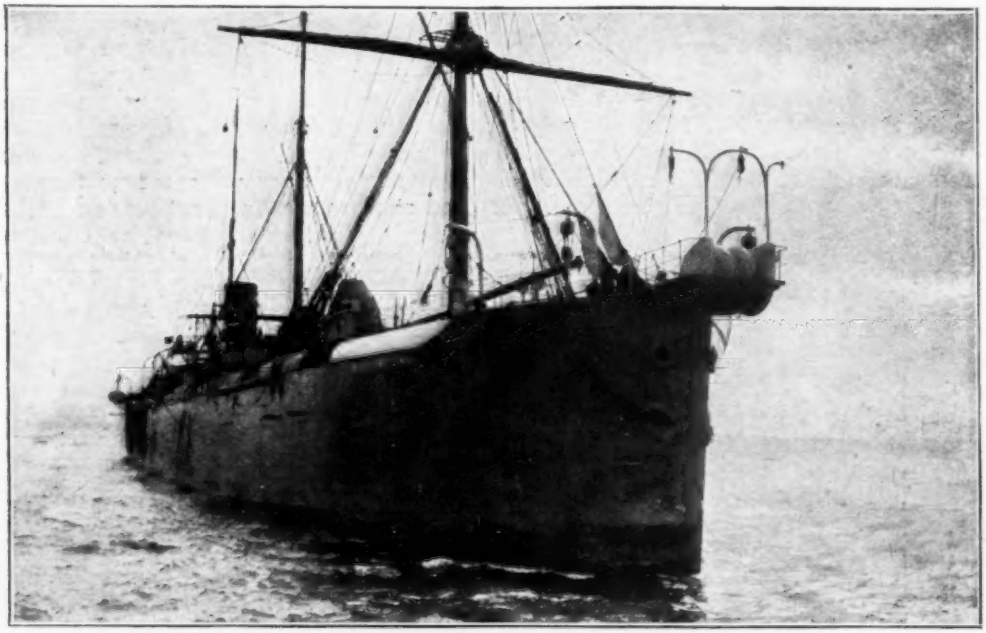
OLD LOG BLOCKHOUSE STILL STANDS

Only a very few of the log blockhouses erected by the early pioneers of the western country from which to repel the attacks of Indians are now standing, and one of these is shown in the illustration. It is located on Lakeview farm, near Fort Casey, Whidby island, in Island county, Wash. A similar blockhouse in the same county was taken down and moved to Seattle where it was placed on exhibition at the exposition.

Practically all the coal consumed in Brazil is imported. Consequently the cost of power has been high, but advantage is now being taken of water power.

MODERN CABLE SHIP

The steamship "Silvertown," the largest of modern cable ships, is shown in this illustration. The curious protuberance on her nose is the great revolving drums by which the miles of cable are paid out. The stern of the ship is provided with the same device.



Largest of All Cable Ships

DANGER OF DEAFNESS IN GUN PRACTICE

That gun deafness has become a great menace to all navies is admitted by many physicians who have to do with the examining of naval men. And, according to Dr. Gilbert T. McMaster, the sharp ring of the 6-pounder, now being generally used in target practice on the American warships, is most likely to rupture the tympanum.

Officers of the navy have complained to Dr. McMaster that this gun, in particular, has a sharp, ear-splitting report, which is repeated during target practice to such an extent that the guns seem to be alive, so rapidly are they served and fired. The air vibrations, repeated at short intervals and with increasing intensity, render all chance of repair of the tissues of the ears next to impossible, and thus may bring on absolute deafness.

The injury may often be avoided, Dr. McMaster believes, by keeping the mouth open, so as to let the air concussion pass through the eustachian tube. The British admiralty has advised the use of an ear plug, which stops the vibration of air from the cannon discharge, but does not prevent the men from hearing orders.

ELECTROCUTED BY VIBRATING MACHINE

Shock from an electric vibrating machine is supposed to have caused the death of Joseph P. McInerney, of Chicago. He was using the vibrator in a bathtub, and as he was pushing it over the region of the heart his back came in contact with the faucets. This sent an electric current through his body which resulted in his death a few minutes later.

EDITORIAL

"John Doe, Manufacturer of Shoddy"—only the name wasn't Doe—is the sign in large letters which appears on a certain factory building in one of the eastern states. The size of the plant indicates a large business and the smoke pouring from its tall stack was evidence of the whirl of busy machinery within. But what a business! Not one redeeming feature. Its very conception is founded on the intention and expectation to deceive. Shoddy contains some raw material, to be sure, the waste from cotton mills which is left after all other possible by-products have been withdrawn, leaving culls of the last degree, the very dregs of cotton. The quantity of this waste is so small, however, that in order to provide a supply to meet the demand resort is had to the daily harvest of the "ol' clos' " and junk man. From alleys, basements, barns, places clean and places foul, flows a never ending grist into the hoppers of the shoddy mill.

Now a customer buying a suit of ready-made clothes or a horse blanket was never known to say, "I don't want all wool, give me shoddy goods," but he does make this mercantile malpractice easy in his effort to get something for nothing, and the unscrupulous dealer takes advantage of this weakness in human nature when he assures the buyer that the ten-dollar shoddy suit is all wool, or equal to what in wool cannot be made and sold for twice ten dollars. And so the double deception goes on, as it has for years past, and doubtless will continue for years to come, unless some pure clothes legislation after the order of the pure food laws is enacted to prevent the adulteration of wool. To return to the sign: what a proud legacy to leave to one's family—"John Doe, Manufacturer of Shoddy!"

* * *

While our own Government has decided that, as at present developed, the dirigible is more desirable than the aeroplane for military operations, there have already been organized both here and abroad numerous concerns for the manufacture and sale of aeroplanes. The new industry has progressed rapidly during the past six months. Bleriot is reported to have already sold 200 machines, which are being turned out at the rate of one per day, while Boisin and Farman have each sold 40 machines, Antoinnette 60 and Bayard Clement promises to produce 1,000 of Santos Dumont's smallest type, during 1910. Most of the machines are one-man type, but a number capable of carrying two persons are included in the list.

New mechanical devices always create new occupations, and in the wake of the aircraft have followed schools for instruction in the building and operation of the aeroplane. As trained mechanics and scientists become more familiar with conditions unfavorable to flight, it may be expected that the present element of danger will steadily decrease. Each accident stimulates fresh endeavor to prevent its recurrence, and by a series of elimination many risks that exist today will one by one disappear. While several instances have occurred recently where the operator of an aeroplane succeeded in getting safely to earth with a broken propeller or a dead engine, no one would think of attempting a descent without power from any height sufficient to cause injury. Now that a practical method of propulsion has been determined, inventors will not be long in taking up the question of safeguarding air flight, and something may be expected in this direction this year. Once this is accomplished factories will spring up like magic and aeroplanes become as commonplace, though probably much less numerous than automobiles.

* * *

The much abused Weather Bureau should be credited with an excellent piece of work, which alone was worth all the service cost for an entire year, and which has not been fully appreciated by the public.

Three thousand men were at work on the railroad extension in the Florida Keys when the Bureau flashed emergency warnings of the approach of a terrific hurricane last October. Hundreds of these men occupied exposed positions on platforms or small areas of filling which rose only a few feet above the water, and whose sole connection with the mainland, miles away, was by means of small boats. Other hundreds were on small islands which were covered with several feet of water when the storm arrived, driving at 100 miles an hour. While hundreds of buildings on the mainland were demolished and vessels in harbors swept from their moorings and hurled far upon the beach, not a single life of all the 3,000 was lost. The warning reached them in time and all were removed to places of safety on the mainland.

The rapid development and increasing utility of the moving picture is an interesting study. Starting as a novelty in one of the best theatres in a few of the largest cities, the idea spread until even the small towns are few which do not now support at least one moving picture establishment. Three years ago films were spoken of in feet; now they are daily produced in miles. In the earlier days subjects depicting crime and vice were common; today the general standard is high, clean, and either amusing or instructive. United States battleships are being supplied with apparatus; when the films have been exhausted on one ship they are exchanged to another vessel and thus make the rounds. A noted horse raiser in Kentucky has pictures made of his horses when running in order to study their qualities and defects. A church in Atlanta uses moving pictures at Sunday evening services, portraying scenes described in Bible history. Colleges and high schools find in moving pictures graphic instruction impossible to convey with equal clearness in printed text book type and illustrations. A recent political meeting in Massachusetts was a failure because the opposing party rented a vacant store and gave a free moving picture show across the street from the intended rally. The unique uses to which this popular form of entertainment are being put might be extended indefinitely. The latest departure, which will soon be ready for use, is an extended series of travel talks, in which the principal sights in all the large cities of the world will be portrayed, accompanied by the delivery of a lecture describing the various scenes. In this way, for a few cents a week, any one can enjoy to a very fair degree the pleasures and improvement of a trip which would require weeks and cost several hundred dollars.

It is not hard to believe that the moving picture is likely to exert in time an appreciable moral uplift in raising the standard among that large class in every large city which now finds its entertainment in places of amusement which are anything but elevating.

* * *

The question of water supply for our cities and towns is attracting more attention each year; especially of late, owing to the decreasing supply and increasing consumption in many parts of the country. Next to air, water is something without which we cannot exist. Rivers and small lakes which 10 years ago furnished an abundant source of supply are constantly shrinking and at certain seasons are almost dry. The growing of forests to conserve the rainfall and melting snow, while desirable, is obviously too long a process to afford relief. Experts on water supply therefore insist that the only solution is to furnish water on a service measured by the use of meters.

It has been previously shown in detail in these columns that of the water pumped into city mains, about 50 per cent only is actually put to any use; the other half is lost through leaks in mains, service pipes, and through being allowed to run to waste. Even so small a stream as one permits to flow from a single faucet during cold weather, in order to prevent freezing of the pipe leading from the house to the street, is reported to represent a waste of from 300 to 1000 gallons in a single night.

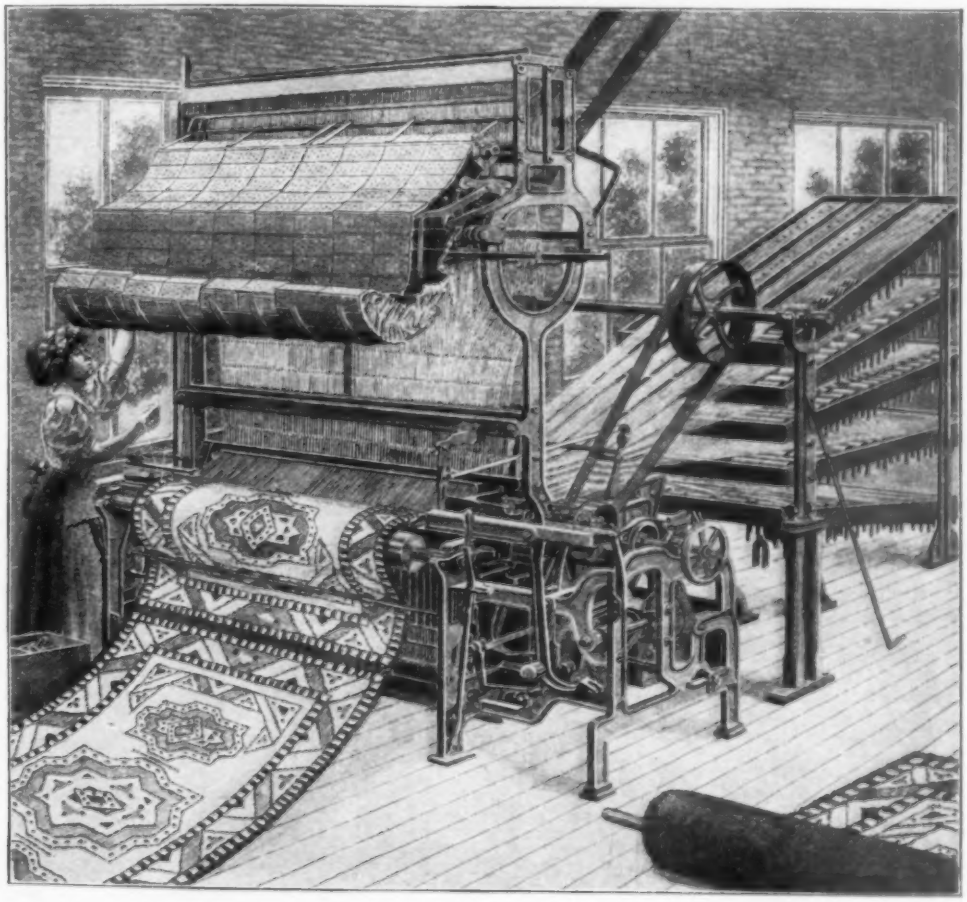
In the large cities of Europe regulations strictly enforced reduce the daily consumption to figures which to our extravagant mode of life seem impossible here. For instance, the total amount of water, for all purposes, consumed daily in Berlin is only 18 gallons for each person, while New York is using 135 gallons and Chicago 200 gallons. Berlin is metered; New York and Chicago meters only the large consumers. It has been claimed that a reduced water consumption, or rather pumpage, would increase the death rate, but on this score the death rate is 20 per cent higher in New York than Berlin, and the typhoid mortality three times as great. The comparison may not be entirely fair, as conditions of climate, quality and nature of food, sanitary regulation, milk supply, and other things may have some bearing, but not sufficient to account for the entire difference. While consumers naturally protest against the meter system, it is evident no other system will enforce economy or prevent unnecessary waste. As an example, take any building where electric light is included in the rent. The tenants allow lights to burn for hours at a time and in unoccupied rooms because they feel they are paying for all the burners all the time, when as a matter of fact the lease contemplates only a necessary use of current.

It should even be possible to make the annual charge for water, under the meter system, less to the householder than on a flat yearly basis, because of the saving in fuel on account of stopping waste, for the chief operating expense of waterworks is the fuel.

H. H. WINDSOR.

AUTOMATIC LOOM FOR RUG MAKING

It is hardly possible to find a well-to-do American's home which is not provided with one or more rugs of the nature of the one shown issuing from this automatic loom, yet few people are familiar with the process by which hundreds of rugs of absolutely the same design and coloring can be made. This is made possible by just such an automatic loom as is shown in the illustration.



Automatic Making of Rugs

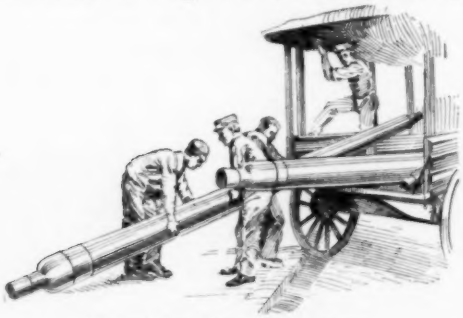
The most important part of the machine is the mechanism at the top of the central standard. The part which looks like a Japanese porch screen, is made of fiber, or sometimes cardboard, and the perforations allow perpendicular wires to drop and lift and lower the warp of the rug so that the shuttle bobbins can pass through with the different colored yarns coming from the racks back of the machine.

The machine is set to manufacture a rug of a certain design and combination of color, and continues to manufacture it until the setting is changed.

The tie committee of the American railway engineering association has decided that no form of reinforced concrete tie has been made that is suitable for heavy and high-speed traffic.

NATURAL GAS SHIPPED IN TANKS

To test the relative values of natural and artificial gas, the Consolidated Gas and Electric Light Co., of Baltimore,



Natural Gas Tanks 22 Ft. Long

caused to be shipped to that city in huge tanks a consignment of gas from the first natural gas fields along the Atlantic seaboard, located in West Virginia.

The tanks in which the natural gas was shipped to Baltimore are shown in the illustration. They are 22 ft. long, 10 in. in diameter, and contain 2,000 cu. ft. of gas each.

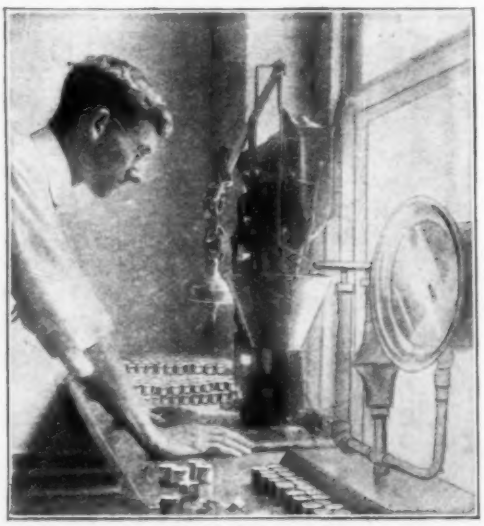
A proposition is on foot to pipe the natural gas into Baltimore, but according to present indications the plan will not be carried out.

GOVERNMENT TESTS OF ROAD MATERIALS

An interesting mechanical equipment has just been installed in the new laboratories of the public roads section of the U. S. agricultural department for the purpose of experimenting with and testing all manner of road making and paving materials. These machines include an electrically operated apparatus for abrasion tests, impact machines, cement testing machines, machines for testing the hardness of paving materials, a diamond core drill for cutting specimens to ascertain their hardness, and a machine for penetration tests.

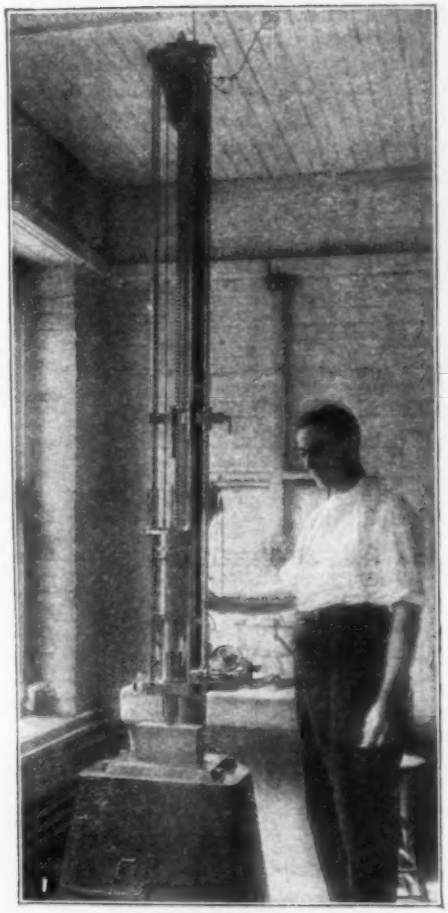
Of the above mentioned machines the abrasion apparatus and the machine for testing the hardness of materials are perhaps the most notable. The former consists primarily of a machine with four cast-iron cylinders mounted on a shaft. The rock to be tested is broken into small pieces and placed in the cylinders, which are rotated at a speed of 30 revolutions per minute. The amount of wear shown at the expiration of 10,000 revolutions determines the test. The machine for testing hardness is a revolving cast-iron disk against which is held perpendicularly a piece of rock cut by means of a diamond core drill. After 1,000 revolutions, sand having meanwhile been fed on the disk as an abrasive agent, the loss in weight indicates the relative hardness of the material.

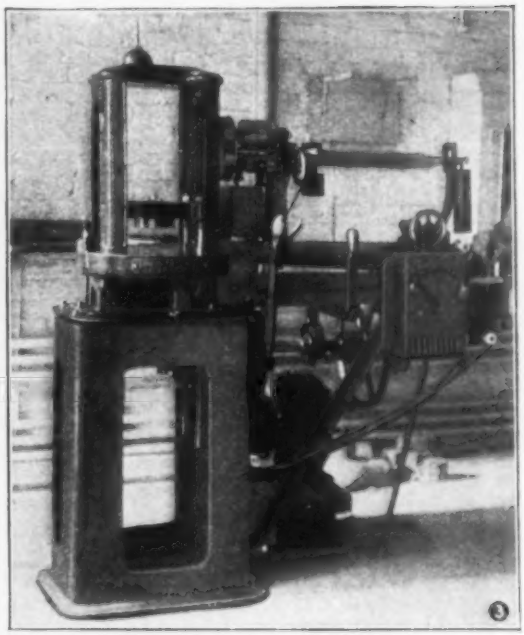
Not only does the public roads section conduct tests and investigation, but it does practical work as well, with a view to demonstrating to the public just how model roads should be built. Up to the present time it has built more than 200 object-lesson and experimental roads in 34 different states, illustrating the best methods of building macadam, brick, gravel, sand-clay, burnt-

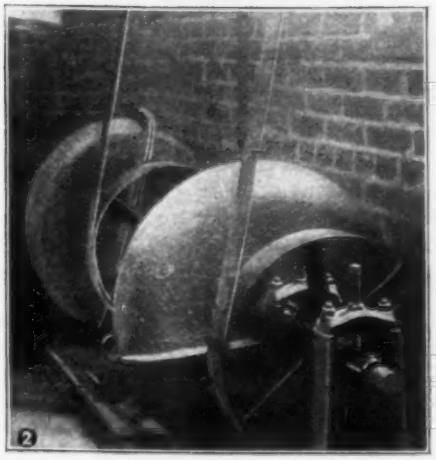


The Cement Test

clay, shell, oiled, and earth roads. A division of road management gives advice on road laws, systems of road management, the proper expenditures for road purposes, etc.







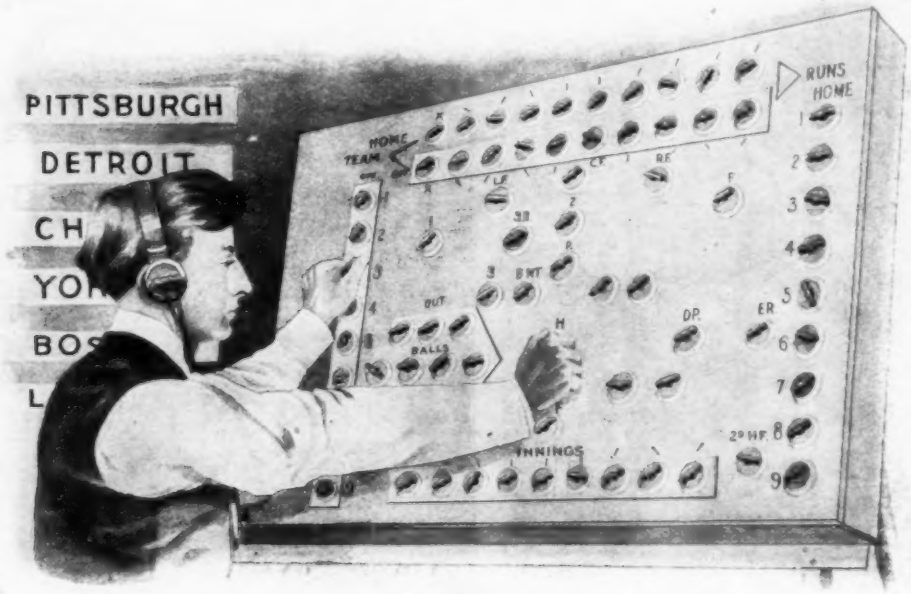
No. 1, Machine for Penetration Tests—No. 2, Electrically-Operated Abrasion Machine—No. 3, Testing the Hardness of Paving Material—No. 4, The Diamond Core Drill at Work

RECORD-BREAKING TELEPHONE INSTALLATION

One of the greatest "rush" installations ever accomplished by telephone men was that in the La Salle hotel, of Chicago, in which 1,100 telephones and complete switchboard equipment were put in position and made ready for operation in just three whole days.

Preparations were made in advance for rushing the equipment on short notice. When the call came late one afternoon for work to commence next morning, everything was in readiness and at 8:30 a. m. the first of 18 wagons was unloaded. Before evening a force of 500 telephone men were at work within the building. This force was reduced to 300 men on the third day.

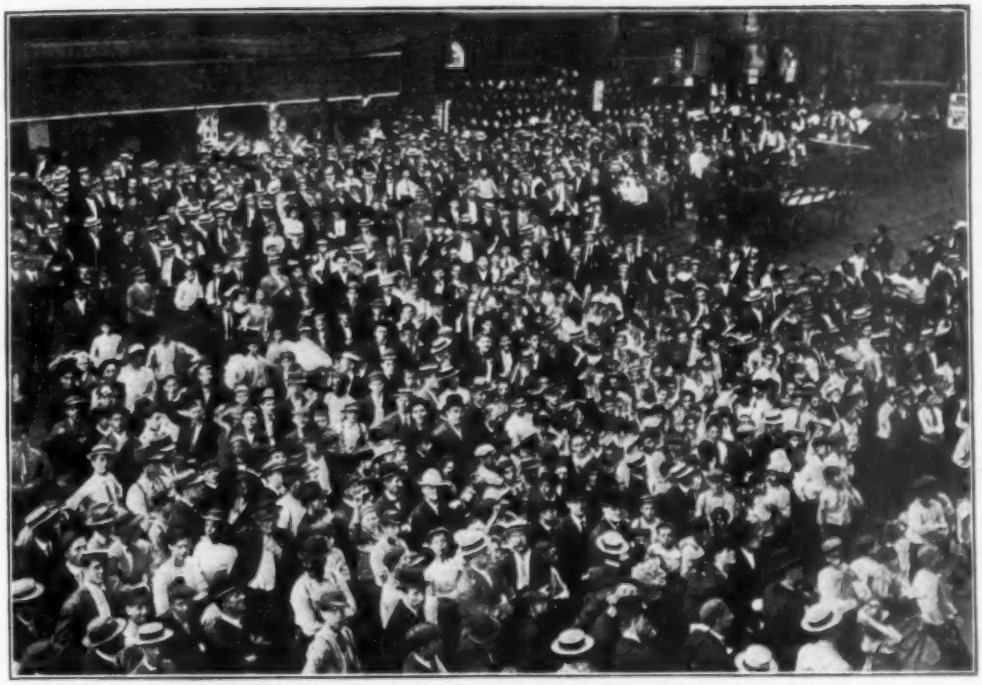
Over 6,000 ft. of lead cable, varying in size from 20 to 400 pairs, and divided into 130 pieces, were used, necessitating many splices. These cables were run up four vertical shafts, one at each corner of the building, and connected to terminal boxes on each floor. Wires were then run through conduits to the telephones in the rooms. The switchboard was in three sections, and had to be assembled and erected before the 1,200 answering jacks, 100 multiple and trunks with cable, relays and terminals could be laid in place. Something like 1,300 jumpers were then run in and connected on the distributing frame. A force of 50 men, divided into two shifts of 12 hours each, was required to install the switchboard and power plant, completing this work in 48 hours.



The Operating Board

REPRODUCING A BASEBALL GAME ON BOARD

By reason of the electric score board, an invention of the past couple of years, it is no longer necessary to attend a baseball game to watch each play in its making. On the board is a diamond and an outfield, and on each side is the complete line-up of all players on both sides. Each player is shown as he goes to bat. The pitcher throws the ball and if it is not hit, the board designates a strike or ball. If the batter connects with the ball, a fair ball or foul is recorded, then the lights that represent the different diamond and



Pittsburgers Watching the Game

field positions show which opposing player received the ball, what he did with it, whether the players made any moves on bases, and whether or not the batter was safe or out.

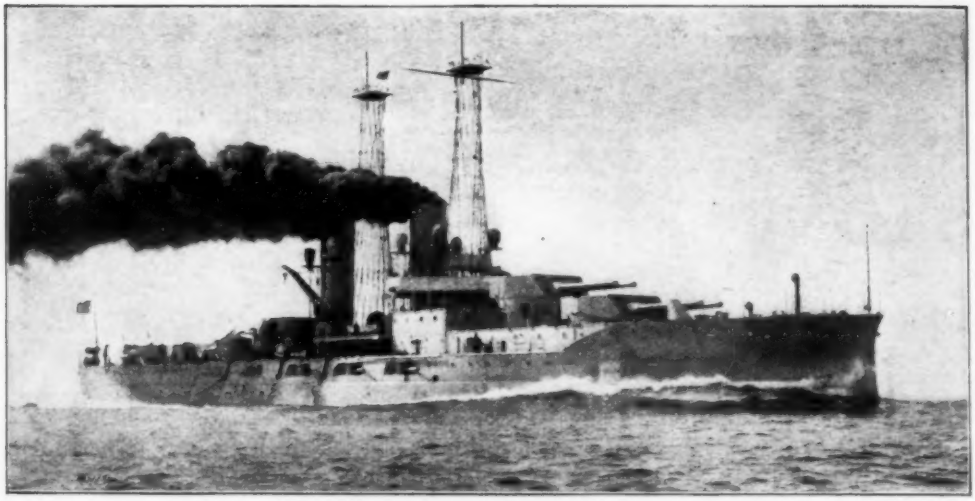
The illustrations show a crowd watching the game as depicted on the board on the front of a newspaper office in Pittsburg, and a view of the operator behind the scenes. The operator has 77 switches at his command, and during a game makes about 3,000 flashes on the board. He receives the plays by telephone directly they are made, and about 16 seconds later they are reproduced on the electric board.

NEW SUBMARINE MINES PROTECT NEW YORK

The City of New York is now better protected against attack from the sea than ever before, its new defense consisting of a number of submarine mines planted in the race at the eastern entrance to Long Island sound. The successful planting of the mines is the outcome of several years of attempts that proved failures. Until the most recent experiments, it was believed by army and navy officers that mines could not be planted in water deeper than 100 or 125 ft., but heavy anchors solved the problem. Now the mines are in position in water that reaches as great a depth as 300 ft., and they are held securely in place by anchors that weigh 1,500 lb.

VARNISH STILL IMPERFECT

Piano manufacturers say that a fortune awaits the man who invents a varnish which will respond to changes of temperature at exactly the same rate as wood responds. The cracking of varnish is caused by the fact that sudden changes of temperature affect varnish—especially fine piano varnish—almost instantly, while the wood beneath contracts or expands at a different rate. An elastic varnish, which some manufacturers say is not impossible, although it has yet evaded the varnish makers, would solve the problem.



U. S. S. "Delaware" on Trial Course off Rockland, Maine

AMERICA HAS MOST POWERFUL AND FASTEST BATTLESHIPS

When the standardization trials of the U. S. S. "Delaware" and "North Dakota" were completed in October and November, the United States became the possessor of the speediest first-class battleships in the world and the most powerful. The "Delaware," which had her trials before the "North Dakota," attained a speed of 25¼ miles an hour, and on her return to Newport News flew three brooms at her mast-head, this indicating a clean sweep of the seas.

But, a few days later over the same course, the "North Dakota" exceeded the above wonderful record, attaining a speed of 25½ miles an hour, and an average of 25 1/5 miles over a measured course. The following day, however, while the 4-hour endurance run was in progress, a 7-in. tube in one of the lower rows of boilers blew out and filled the room with steam, four men being seriously scalded and 12 others slightly so. Later, one of the men died. The engineer immediately cut off four of the 14 boilers, and as soon as the extent of the injuries was ascertained the ship was headed for Portsmouth. Under the 10 boilers remaining in use a speed of 24¼ miles an hour was maintained.

While the "Delaware" is equipped with reciprocating engines, the "North Dakota" has turbines, which, according to many of the officers, makes her the better ship of the two.

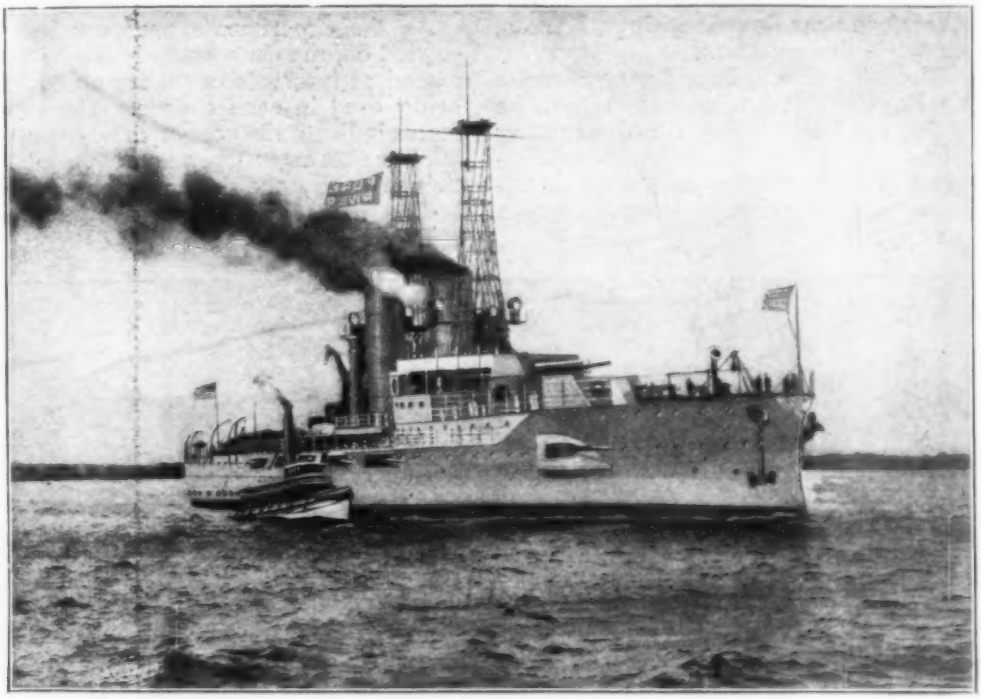
In the first place, there is claimed to be absolutely no vibration of the fire-control masts when the vessel is equipped with turbines, while all reciprocating engines, in the past at least, have greatly lessened the value of these masts because of excessive vibration. It is also claimed that the "North Dakota" can maneuver as quickly with the turbines as ships equipped with reciprocating engines, regardless of the fact that her propellers are but 13.6 ft. in diameter as compared to the 18-ft. diameter of the propellers of the same size ship equipped with reciprocating engines. From half speed ahead, when the propellers were making 120 revolutions a minute, they were reversed in 10 seconds.

Another interesting feature of the two ships is the fact that they use oil fuel in conjunction with the coal. Oil is sprayed into the furnaces over the

coal under high pressure. The average horsepower developed by the "North Dakota" in her five trial runs was 33,675, while the "Delaware" developed 28,578 hp.

coal bunker capacity about 2,300 tons.

The armament of both ships consists of ten 12-in. guns; fourteen 5-in. rapid-fire guns; four 3-lb. saluting guns; four 1-pounder, semi-automatic



U. S. S. "North Dakota"

The length on load waterline of both vessels is about 510 ft.; breadth, extreme, at load waterline, about 85 ft. 2⅝ in.; displacement 20,000 tons; total guns; two 3-in. field pieces; two machine guns; and two submerged torpedo tubes. The 12-in. guns can be fired on either broadside.

DYNAMITING HARDPAN SUBSOIL INCREASES LAND VALUES

Under the direction of Prof. A. M. TenEyck, the Kansas State Agricultural College is conducting experiments in dynamiting the hardpan subsoil which is characteristic of certain sections of that state and which also exist in other parts of the country. This hardpan lies from one foot to three feet below the surface, and is usually covered with soil of a good texture. The hardpan itself varies in thickness from one to two feet and is usually so compact that it is almost impervious to water. Such land fills with water during a rainy season, becoming very wet and untillable, while during dry periods the crops suffer from drought, since capillarity cannot readily draw the water stored in the subsoil below the hardpan strata. The subsoil is usually fertile and of good texture, similar to the soil which lies above the hardpan.

By blasting with dynamite, this hardpan layer may be thoroughly broken up so that it may be penetrated by

water and the roots of plants. The question which has not been fully determined is whether this condition produced by the blasting will remain permanent. Experiments are being conducted on the farm of ex-Governor Crawford near Baxter Springs, Kansas, to settle this question.

Prof. TenEyck, in a communication to Popular Mechanics, states that, as it is now being done, the dynamiting of land is an expensive way of reclaiming the hardpan areas, and does not recommend it, except in a small way, as an experiment.

The plan on which the experiments are being conducted is to carry out different systems of soil culture and of rotation of crops on the land which has been blasted in order to determine what methods of farming will best prevent the hardpan subsoil from returning to its compact cemented condition. There is no question but that the dynamiting breaks up the hardpan and for a time, at least, puts the subsoil in better physical condition for absorbing and holding water and for growing crops. If this condition can be maintained, it will mean larger crop yields and an increase in land values in those localities where the hardpan subsoil is prevalent.

As the experiments are now being carried on, the charges of dynamite are placed at intervals of 20 ft., one stick being used in each charge. The estimates indicate the cost of the dynamite is about $8 or $10 per acre. In addition to this, the labor required for boring holes and blasting is considerable.

The Passing of the Biddle House

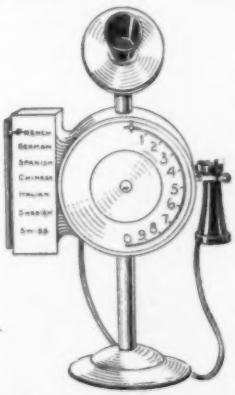
FIRE DESTROYS OLD LANDMARK IN DETROIT

With the destruction of the old Biddle House in Detroit, recently, one of the best known of the older hotels of the country, and a spot rich in anecdote and story passed from view. The fire which destroyed the old building was a spectacular one. From 1849, when it was erected, until 1893, it was occupied as a hotel, and many notable

people graced its lobbies. It was the scene of many political rallies and conventions. It was used as a theater for a while and Edwin Booth and Lawrence Barrett played there.

AN INTERPRETING TELEPHONE

The reader must not be led to think by the above head that any such wonderful device has yet been invented, or that there is anything but a very distant likelihood of such a device in the future. Yet, every great invention has appeared impossible to the many and difficult to most before its arrival, and very simple afterwards.



The interpreting telephone, however, is nothing more or less than the prophecy of a Michigan inventor, who believes the time will come when a person at one end of the line can speak one language and that any language can be heard at the other end. That is, any language the telephone is provided with. The drawing shows the Michigan man's idea of how it is to be accomplished. Attached to the side of an ordinary telephone receiver is a box in which the different languages are stored. If the man answering the phone is Chinese, he will move the indicator opposite the Chinese language, and then some mysterious mechanism yet to be designed will receive the English words coming over the wire and convert them into Chinese.

THE RIVALS OF THE "ZEPPELIN"

The Zeppelin type of airship has two rivals in Germany, the Parseval type and the Gross type, the latter being

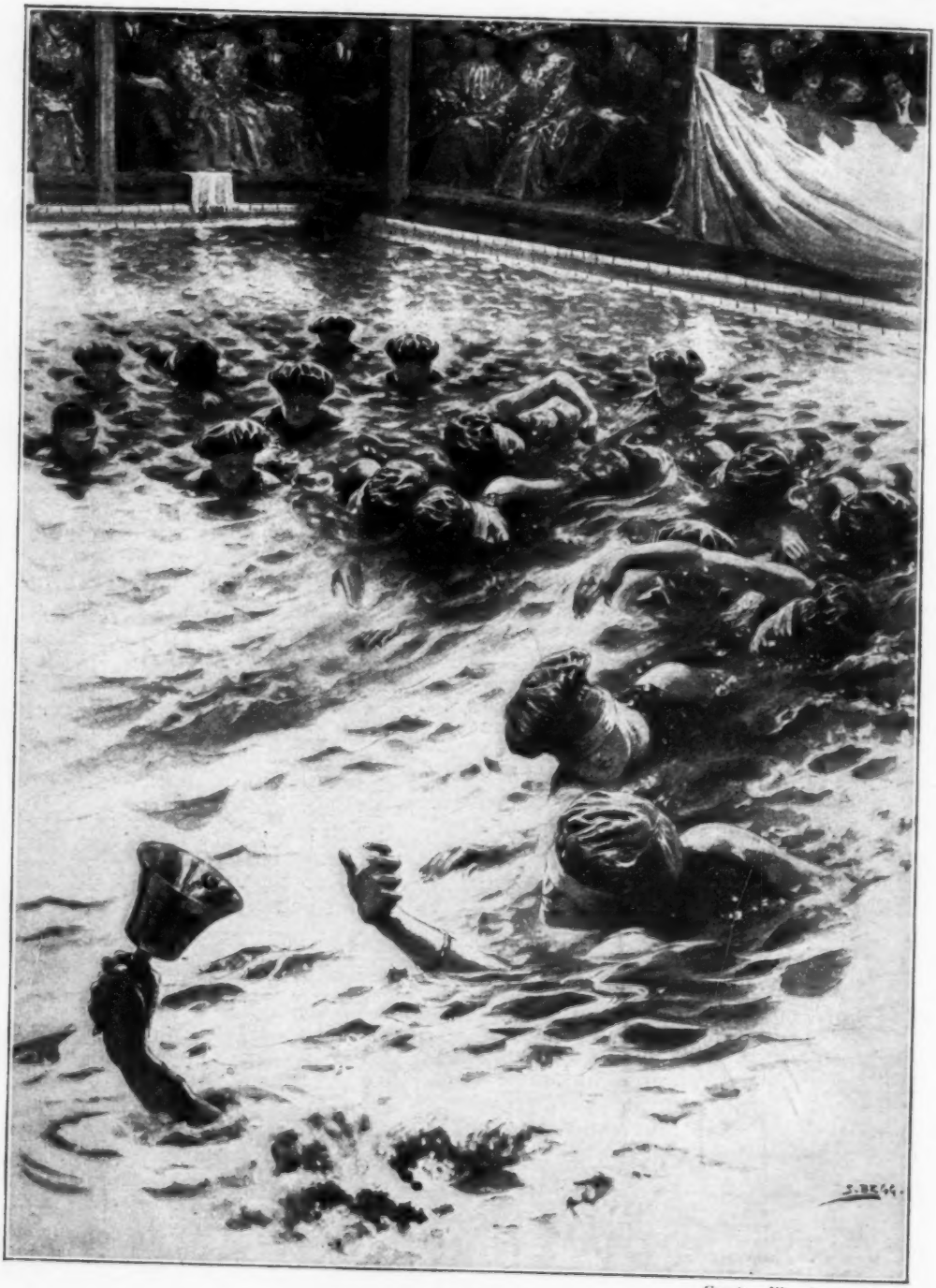
Leaving the Dirigible Garage

shown in this illustration. In the background is one of the great dirigible garages of the German army. It is 1,500 ft. long, 480 ft. wide, and 120 ft. high. The doors are 90 ft. in height, and are opened by means of power from an electric motor.

The "Gross" and "Zeppelin" have been undergoing extensive tests in company, so as to compare the best features of both.

WASHINGTON AQUEDUCT STILL UNIMPAIRED

The Washington aqueduct, which crosses 26 valleys on four bridges and 22 fills containing culverts, and can provide the nation's capital with 90,000,000 gal. of water per day, is still in excellent condition, although it has seen 46 years of service. The only sign of deterioration is found in the unlined portions of the conduit where a small quantity of rock had fallen from the roof and sides. The mortar in the brick masonry has not been washed out to any extent.



Courtesy Illus. London News

All After the One Man

A BLINDFOLDED SWIMMING GAME

This illustration presents the pictured details of a new swimming game that is presumably an attraction at the private swimming pools in London. One swimmer is supposed to carry a bell which is rung as often as possible without the ringer being caught by the blindfolded swimmers. At times, the possessor of the bell will dive under the pursuers, appear behind them, and ring again, to their bewilderment. The game, in fact, is a reversal of blindman's buff, as in the latter there is but one pursuer, while in the former all but one are pursuers. The pursuers in the illustration are all women swimmers, but the person with the bell is a man.

AERIAL FLIGHT IN DISTANT LANDS

That the aerial fever is spreading to every corner of the earth is well borne out by the reports received from many different points. An aviation meet was held near the Pyramids in Egypt in January, while a syndicate of the municipality of Saigon, Indo-China, has bought a Blériot and founded an aero club. An aero club has also been founded by aerial enthusiasts in the Argentine Republic, and the first machine ordered is a Blériot. Australia also has a club.

STAUNCH GUIANA FISHING BOATS

The little fishing boats generally used along the coast line of the Guianas are built of the hardest wood grown in South America and can stand almost any amount of knocking about. They are flat bottomed, that is, they have no keel, a fact which makes it possible to use them on the parts of the coast where enormous mud flats make the water very shallow.

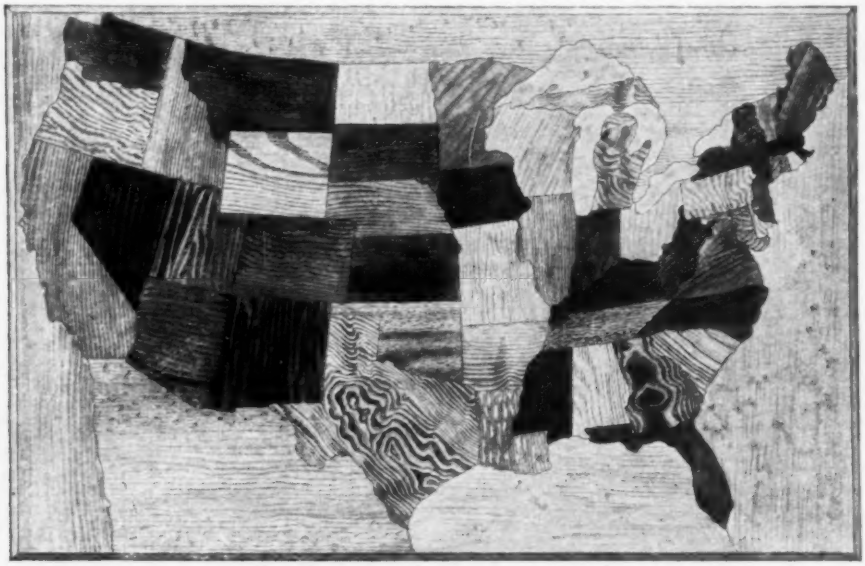
South American Fishing Boats

The municipal court of Boston has decided that a man has the right to do his own plumbing provided he does it in accordance with plumbing regulations and in a manner suitable to pass inspection.

INLAID TOP OF TABLE REPRESENTS U. S. MAP

The unique map of the United States shown in this illustration is formed by the inlaid work of a table top. The shape of each state is cut out of wood that grows in that state, and the natural colors, or shades, have been varied as much as possible.

The state of Massachusetts is represented by a piece of wood from the old Charter oak tree, this specimen being secured by Capt. Dimock, of the Hartford, Mass., fire department, after much trouble. The table is the work of Capt. Caleb Shinkle, of the Anderson, Ind., fire department, and all the pieces of wood used were secured from captains of fire departments in the different states.



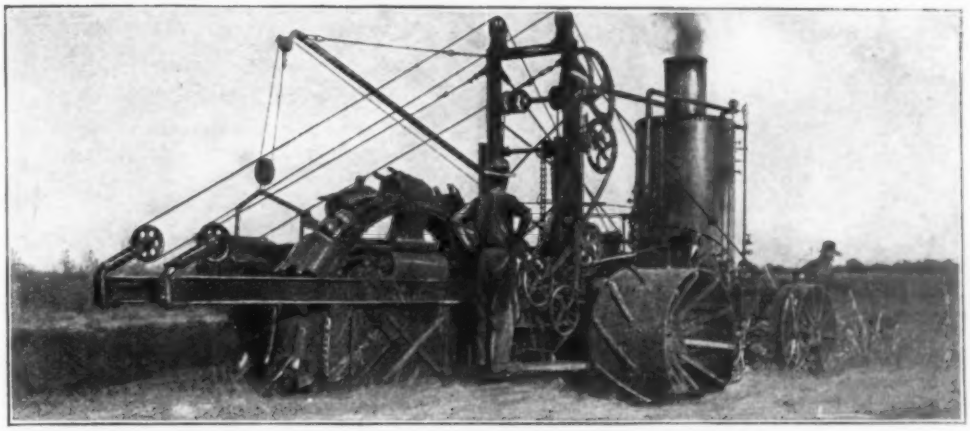
U. S. Map in Inlaid Table Top

PIG FLIES IN AN ENGLISH AEROPLANE

Probably one of the oldest sayings in England—"Pigs must fly"—, a phrase for expressing the improbable, has, through the offices of Moore Brabazon, the English aviator, been given its death blow as far as public fancy is concerned. For, one pleasant afternoon when the wind was friendly to aerial flight, someone suggested to Brabazon the idea of taking a pig up in his aeroplane as a passenger, and thereby helping this pork-producing animal to accomplish what had so long been proverbially impossible. Consequently, a good-sized pig, six weeks of age, was placed in a basket, and rode in close proximity to the engine during a short but rapid flight.

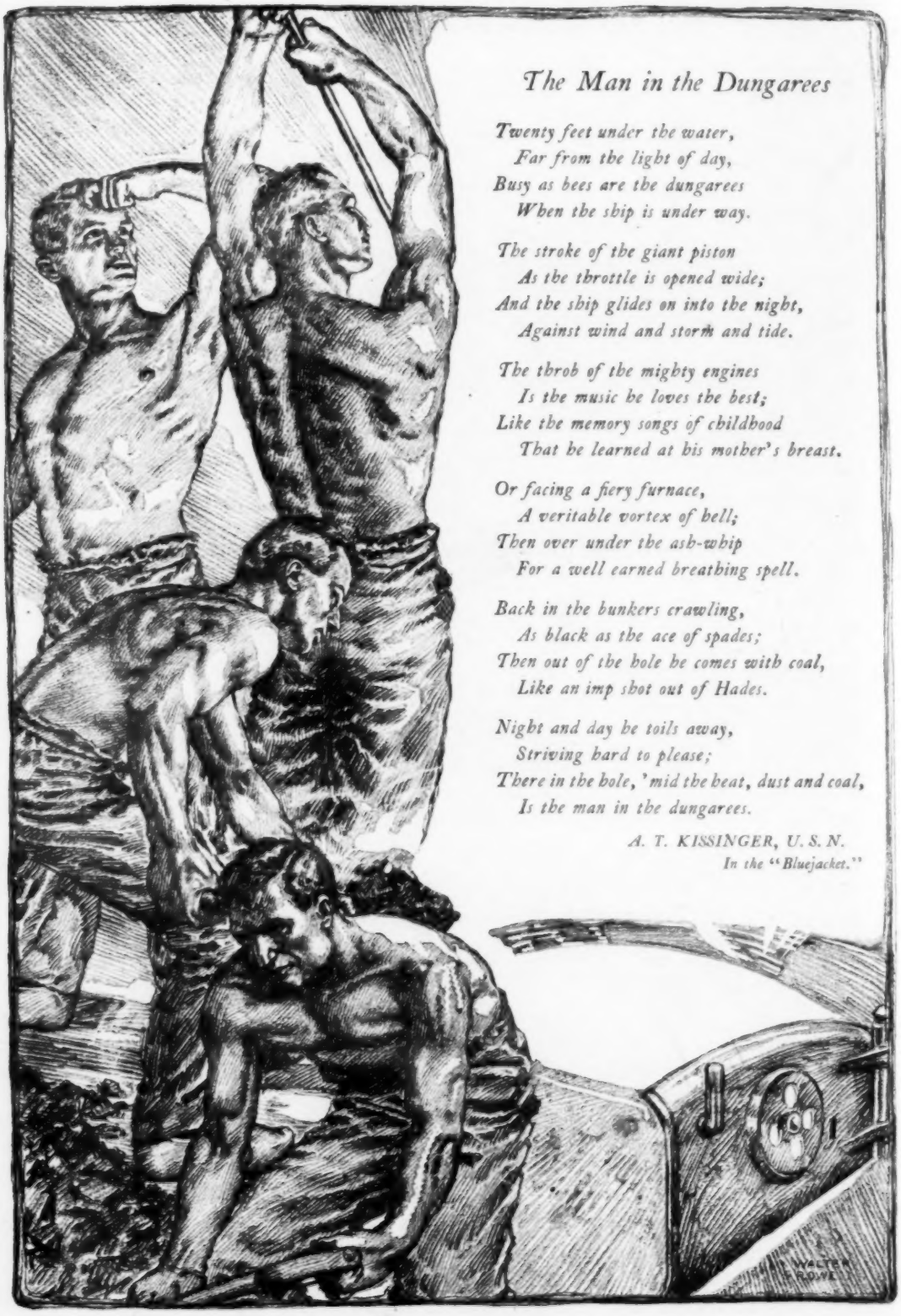
BUILDING A GAS-PIPE LINE IN TEXAS

A long gas line to connect the Henrietta oil and gas fields in Texas with Ft. Worth, a distance of 106 miles, and Dallas, a distance of 140 miles, is now under construction. The trench work is being done by the machine shown in one of the illustrations. It can dig a ditch 3 ft. deep, 2 ft. wide, and from ½ to ¾ of a mile long in a day. When the trench is dug, beams are laid across, and the sections of 16-in. pipe that are to carry the gas are joined together before being lowered. The other illustrations show one section of the line connected up and ready to be lowered into the trench and a stretch along



Digging Three-Quarters of a Mile of Ditch a Day—The 16-In. Gas Pipe Connected and Ready for Lowering—Pipe Lying Along the Line of Ditch

which the pipe is being joined. The smoke seen in the distance in two of the illustrations is made by the excavating machine.



The Man in the Dungarees

Twenty feet under the water,
Far from the light of day,
Busy as bees are the dungarees
When the ship is under way.

The stroke of the giant piston
As the throttle is opened wide;
And the ship glides on into the night,
Against wind and storm and tide.

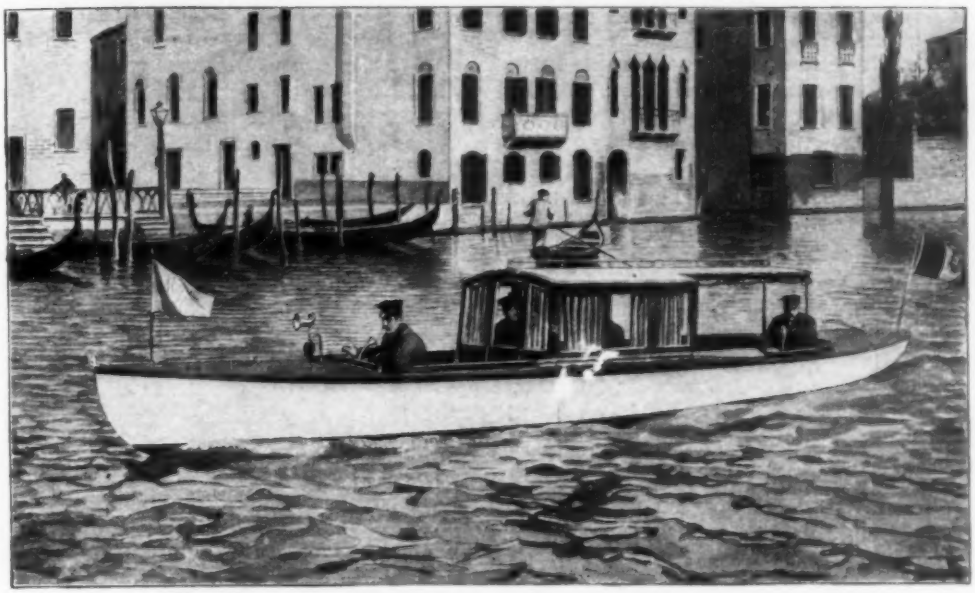
The throb of the mighty engines
Is the music he loves the best;
Like the memory songs of childhood
That he learned at his mother's breast.

Or facing a fiery furnace,
A veritable vortex of hell;
Then over under the ash-whip
For a well earned breathing spell.

Back in the bunkers crawling,
As black as the ace of spades;
Then out of the hole he comes with coal,
Like an imp shot out of Hades.

Night and day he toils away,
Striving hard to please;
There in the hole, 'mid the heat, dust and coal,
Is the man in the dungarees.

A. T. KISSINGER, U. S. N.
In the "Bluejacket."



Motorboat in Venice, the Envy of the Gondoliers

THE SUCCESSOR OF THE GONDOLA

There has been much excitement in Venice in the past two years over the threatened invasion of the motorboat as a rival of the romantic gondola, and many lovers of things ancient and unchanging have decried the idea. Some time ago, several of the associations of the city, including the socialistic element, petitioned the city authorities to prohibit the use of motorboats as common carriers on the famous canals, but this request was denied.

The accompanying illustration shows a motorboat of the type that is now replacing the gondola. Its lines, patterned to some extent on those of the gondola, are very graceful. In the background is a fleet of the older craft.

A WHEELED TRAY SET

The wheeled tray set shown in this illustration is designed to save work and trouble in homes of moderate means. The trays, which are removable, are supported by a steel frame carriage with three 8-in. rubber-tired wheels, and as the front wheel swings on a pivot it is a simple matter to move it in any direction. The top tray is 23 by 28 in. in dimensions and it rests 31 in. from the floor, which is the height of an ordinary dining table. The lower tray is 21 by 26 in. and rests on a frame 14 in. beneath the upper tray.

Handy Tray Set for Serving Luncheons

WHERE EGBERT FELL

Not only is the city of Manila dotted profusely with monuments both to departed Spaniards and Americans, but the places where such illustrious characters as Lawton, Egbert, Logan, and other brave soldiers fell, in the wilds of outlying provinces, are likewise marked by substantial memorials. In the illustration is shown the fitting monument, built of concrete and old cannon, which marks the spot where Col. Egbert was shot down by the insurgent forces near Polo, Bulacan province. This monument was erected under the direction of Egbert Post, Veteran Army of the Philippines, of Manila, and one exactly like it has been erected by Lawton Post, V. A. P., to mark the spot where their hero fell, near San Mateo. Each year this order decorates these memorials.—Contributed by Monroe Woolley.

A Soldier's Monument in the Philippines

FISHING WITH KITES

Fishing with kites is claimed to be entirely practicable by a fisherman living on Lake George, Can. He insists that the fish are somewhat frightened of a boat, but will readily grab a hook strung from a kite. His method is to fasten one or more fish lines to the kite cord, and then to play the kite out until the kite cord hangs low enough and far enough out to drop the baited hooks of the fish lines to the required depth in the water.

Considerable experimenting had to be done by the kite fisherman before he could determine the length of his fish lines and where to locate them on the kite cord.

STORM DAMAGE AT KEY WEST

The result of the hurricane which struck Key West in October, inflicting a property loss of about $2,000,000 and forcing the proclaiming of martial law for a few days, is partially shown in these illustrations. The estimated velocity of the storm was 100 miles an hour.

One of the illustrations shows the wreck of the coal hoist of the U. S. navy. The work of repairing it and the dock cost the government about $50,000. The other illustrations show the remains of the Manuel Lopez cigar factory, a building built about a year ago at a cost of $25,000, and fire engine house No. 1. The Lopez building was a total wreck, putting 300 persons out

The Wrecked Coal Hoist—Remains of the Lopez Cigar Factory—Total Wreck of Fire Station

of work for the time being. In the collapse of the fire station, all the apparatus was wrecked and five of the horses were killed.

FOOTBALL ADAPTED FOR THE PARLOR

Several years ago, tennis, under the guise of ping-pong, was adapted for play in the parlor, but the more strenuous outdoor games, such as baseball and football, were considered to be on too big a scale for indoor adoption without an almost complete loss of the features that make such games exciting. An English inventor, however, has now devised a parlor football game that retains much of the interest of the game as played on the gridiron.

It consists of a table, not unlike that used for billiards but much lighter, on which a miniature football field is laid out. Goal posts are placed at each end, and the football is an ordinary tennis ball. The game is called hurricane football, and each player has a length of nozzled hose attached to a bellows which he works with his foot. Each side strives to drive the ball through its opponent's goal by means of the air blasts, and the success or failure of one side to score is determined to some extent by that side's ability or strength to pump the bellows.

In the game shown in the illustration, each side has three players, one player on each side doing nothing more than is required to guard his goal. It is the one type of football game in which danger is eliminated.

The Hurricane Football Game

THE BROOMCORN CROP IS SMALL

It has been figured out that the broom crop for 1909 allows but one and one-seventh brooms for each family. The statistician who figured this out makes no allowance for the use of brooms by railroads or city street cleaning departments. This may be sarcasm on his part. The apportionment of brooms was figured on the fact that the broomcorn crop yielded 16,000 tons, which would make 17,280,000 brooms; 15,000,000 families use brooms.

HOW TO MAKE AN ARM CHAIR

The arm chair here described and illustrated is intended to be one of the set of diners made after the design of the side chair described on another page. The same general directions for making the side chair apply equally to the arm chair.

The stock given in the following list should be purchased surfaced on four sides and well sandpapered:

2 rear posts, 1½ by 1½ by 38 in.
2 front posts, 1½ by 1½ by 26½ in.
9 rails, ⅞ by 2 by 19½ in.
1 rail, ⅞ by 1½ by 19½ in.
3 slats, ½ by 2 by 12½ in.
2 arms, ⅞ by 4½ by 20½ in.
2 brackets, ⅞ by 2¼ by 2½ in.
2 cleats, ¾ by 1 by 19 in.
4 slats, ¾ by 2 by 19 in.

Prepare the posts first by cutting them to the lengths shown in the draw-

ing. In the photograph the front posts have their tops cut off square and the arms fastened to them by means of lag screws. A better way from a mechanical point of view would be to shoulder the top ends on the four sides, cut through-mortises in the arms and insert these tenoned posts into these mortises, pinning the arm to the post by means of small dowels in the edge of the post and through the tenon.

The brackets under the arms are to be fastened to the posts and arms by means of concealed dowels and glue of good quality.

All of the rails should be tenoned into the posts thoroughly, even if the lag screw fastenings are used. If the lag screws are used, the tenons may be what are known as stubb tenons—tenons of short length. Good hot glue should be used in either case.

The shape of the arms is indicated in the drawing. They are fastened to the rear posts by means of dowels and glue.

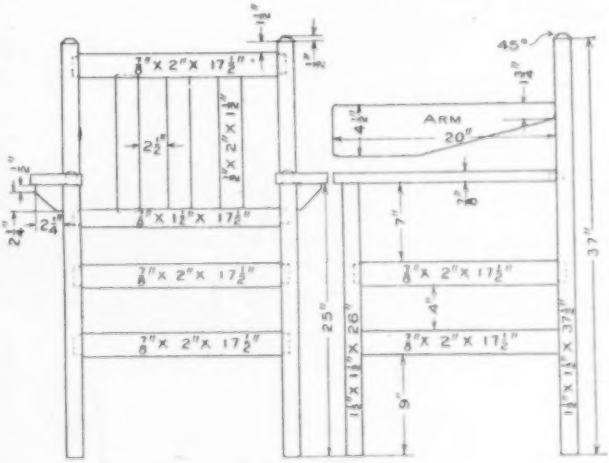
The slats, or verticals, of the back should not have their ends tenoned but should have the mortises in the rails cut sufficiently large to "let in" the whole end of each. This is much easier and more likely to result in a satisfactory fit than to shoulder them. Any unevenness in the lengths of the respective slats will not affect the fitting of the joints by this latter method.

The tops of the rear posts in this chair, as in the side chair, are cut to angles of 45 deg. beginning the slope at lines marked ½ in. from the tops.

The bottom is made up of 2-in. slats fitted between the front and back rails and fastened to cleats which have been previously fastened to the insides of the front and back rails. Keep these cleats low enough on the rails so that the top surfaces of the slats shall rest somewhat below the top edges of the rails. Cushions, such as the one shown, can be purchased ready made or they can be easily made by the amateur.

Arm Chair Complete

A good finish for this chair and its mates is obtained as follows: Apply one coat of brown Flemish water stain. This stain in the original package is very dark in tone and unless an almost black finish is wanted should be light-



Details of Chair Construction

ened by the addition of one-half or two-thirds water. Apply with a brush or sponge and allow to dry over night. When dry, sandpaper lightly with fine or worn sandpaper to remove the raised grain caused by the water of the stain. Put on a very thin coat of shellac. This is to prevent the "high lights" in close grained woods from being discolored by the stain in the filler which is to follow. The shellac being very thin does not fill the pores of the wood perceptibly. Next, sand the shellac coat lightly when it has hardened. Apply a coat of paste filler colored considerably darker than the stain to the tone desired for the open grain. If the filler is well stirred and properly applied, one coat ought to be sufficient. If it does not fill the pores satisfactorily, apply another coat when the first has had time to harden. Vandyke brown is used to color the filler, if none but natural color is to be had. On the hardened filler apply a thin coat of shellac. On this apply several coats of wax. The directions for waxing will be found upon the cans in which the wax comes.

MOVING PICTURES OF GERMAN ROYALTY

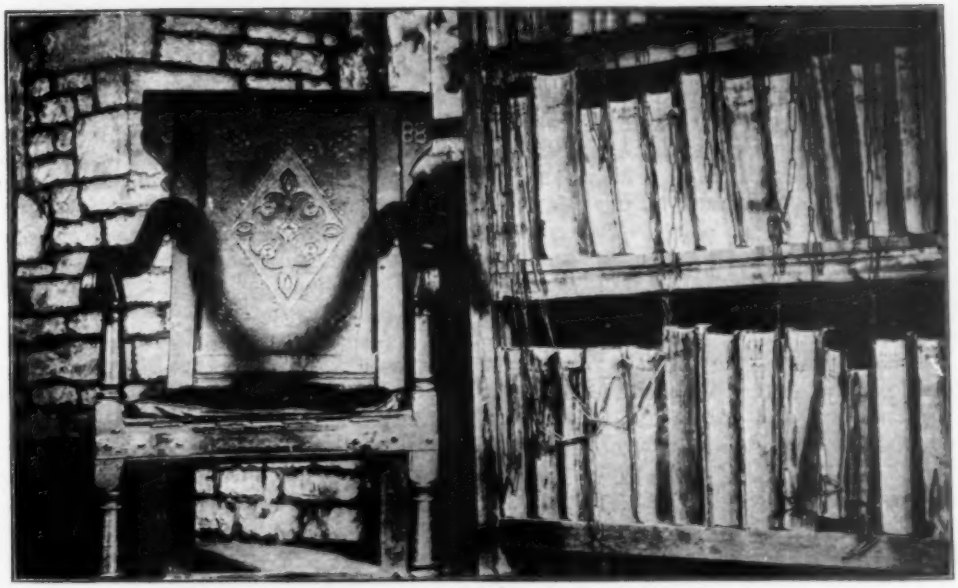
In the latest moving pictures taken by the royal cinematographers at the command of Emperor William, the crown prince of the German ruling house is shown leading a fierce charge across the parade ground. After the charge he was taken while instructing his officers in the art of handling cannon, and places a shell in the breech with his own hands.

The films have been ordered put on sale, according to reports from Germany, so that the millions of people who patronize the moving-picture theatres may see how their future emperor really appears in battle array.

TWO MILLION OLD SHOES

This huge pile of old shoes, enough to absolutely bury a score of wedding parties, is estimated to contain 500 tons, or about 1,000,000 pairs. They cover a large junk yard in Newark, N. J., and are to be used in the manufacture of potash.

The Wear of 2,000,000 Feet



Ancient Volumes in Chains

A CHAINED LIBRARY IN ENGLAND

One of the most curious libraries in all of England is the chained library of the Grantham parish church. Each volume, every one of which is large, is fastened to the shelf by a chain sufficiently long to allow of them being taken from the shelves and looked over. The chair is for the comfort of the reader. The date on the chair is 1688.—Photo by Miss Beatrice Oliver.

MAP OF DESERT WATERING PLACES

The wells and springs of the great American desert are few in number and very irregularly distributed. So irregularly, in fact, that in some districts watering places occur in groups, and in others are 30 to 50 miles apart. Unusual activity in railroad work has so stimulated prospecting that there is a large influx of strangers, many of whom do not fully realize the danger of traveling through such an arid region. Consequently the geological survey has issued a map that shows the location of all watering places, together with information as to the possibility of locating and developing water at other points. More than 300 watering places are described and mapped and the principal roads through the desert are also traced.

AUTO DANGER SIGNS IN ENGLAND

Owing to the fact that the county authorities of England are under a statutory obligation to set up road signs, the Royal Automobile club has determined to set up no road signs of ordinary character. Accordingly, the club sign is intended to be used only to supplement the ordinary signs in exceptional places where danger is of so pronounced a character as to require the greatest care of the most careful drivers.

The sign shown in the illustration is placed at points where a cross road or a dangerous hill occurs immediately after a blind corner, and where other conditions of as dangerous a nature are present.

BUILDING THE DETROIT RIVER TUNNEL

By R. Marshall, Associate Editor of "Concrete"

In making tunnels they used to bore through solid rock, but modern science has found a better way. The Michigan Central railway, in tunneling under the Detroit river, laid two steel tubes on the river bed, covering and lining them with concrete. The tunnel is now ready for use and connects the United States and Canada at the cities of Detroit, Mich., and Windsor, Ont. Two long tubes of concrete, with steel centers, stretch from one country to the other and through them pass freight and passenger trains, hauled by electrical engines.

First a trench, 48 ft. wide at the bottom, was dug across the bed of the river. The sides sloped ½ to 1 and the depth of the trench was just enough to bring the tunnel tubes even with the bottom of the river. A course of sand and gravel one foot to a foot and a half deep was placed in the bottom of the trench and on this a network of steel I-beams was arranged. This grillage of I-beams was embedded in concrete and was designed to support the tunnel tubes.

The steel tubes for the tunnel proper were constructed about a mile up the Detroit river. They were built of heavy steel plates, and were tied together in pairs, each pair forming a section of the tunnel. Each section was encased in a wood framework, and the ends of the tubes were tightly plugged with wood bulkheads. On top of the wood framework were air tanks. The section was launched from the steel shops and was towed down the river by tugs to the tunnel site.

When the section had been brought to a position directly above its final resting place, valves in the bulkheads were opened, allowing the water to come in, sinking the section. When the section neared the bottom of the river it was manipulated by the air tanks on its top. Thus the section could be moved a short distance in any direction. Masts on the ends of the framework stuck up out of the water and acted as surveyors' rods for the engineers on shore who determined when the section was exactly in position.

Divers formed the connection between the new section and the one previously placed. The tubes were equipped on the ends with male and female flanges and when these were firmly riveted together, they compressed rubber gaskets at the joint and made an airtight connection.

Thus all of the eleven sections of the tunnel were sunk. As soon as a section was in place, the concrete jacket was put on it and later the entire interiors of both tubes were lined with concrete.

The methods of placing the concrete around the steel tubes after they were sunk in the bottom of the river are of great interest. Concrete is a mixture of Portland cement, sand and gravel. The important feature is the cement. This material binds the sand and gravel into a solid, monolithic mass that is artificial stone. To be successful, the method of making concrete must be such that the cement is given a chance to work. Concrete mixed on shore and thrown into the water will not "set," because the water will wash the cement coating off the sand and gravel grains and there will be nothing to bind them together.

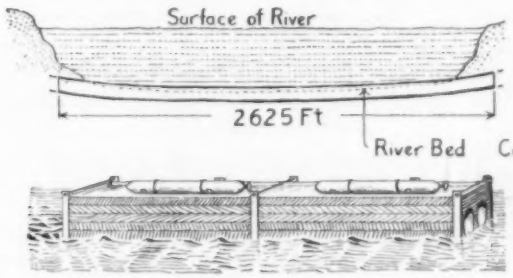
Heretofore the method has been in placing concrete under water, to fill bags with concrete and lower them to the place desired. This is slow business. In the Detroit tunnel work a comparatively new method was used. A concrete mixing plant was equipped on a scow anchored directly over the section to be embedded in concrete. Scows with sand, gravel and cement were tied to the machinery scow, which was equipped with concrete mixers, hoists, engines, derricks, etc. Clamshell buckets transferred the sand and gravel from the small scows to the hopper bins over the mixers. A chain conveyor kept the mixers supplied with

Portland cement. As the concrete came from the big mixing machines it was dumped into buckets that were hoisted to the upper deck of the scow and dumped into the mouths of three steel tubes that extended down to the bottom of the river. These tubes (one to handle the output of each mixer) were made of ⅜-in. cast-iron plates. At the top of each tube was stationed a man who regulated the flow of concrete into the tube. At the bottom was a diver who guided the bottom end as a gardener guides the stream of a watering hose. The tube was filled with concrete before it was put in the water and the flow of concrete through it was kept constant. The bottom end of the tube was at all times kept below the surface of the concrete mass, so that the river water did not have a chance to disturb the concrete mixture. Only the surface of the concrete jacket was exposed to the river water.

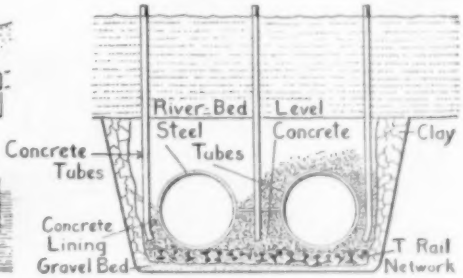
As the tunnel tubes lay in the trench on the concrete platform in which was embedded steel beams, the remainder of the trench was filled with concrete and the tunnel section was covered over with concrete. Between the concrete jacket thus made and the mud of the river bottom was placed a course of clay. The concrete jacket was built as described, one tube from the mixing scow supplying the concrete either for one side or the space between the twin tunnel tubes. Thus three concreting tubes were necessary.

As soon as all the sections of the steel tunnel tubes were in place and their concrete jackets on, the concrete lining was started. Each tunnel tube is large enough to accommodate a standard gauge railway track, with a ledge on each side for the use of pedestrians. A concrete lining, about 2 ft. thick, was placed in each tube. This work was comparatively easy. Suspended from the top of the tube hung a platform. On this platform ran the cars carrying the concrete. The bottom of the tube was paved first, then the side walls and finally the arch. Embedded in the concrete lining, steel rods were placed, for reinforcement.

This steel-tube stretch of tunnel under the Detroit river connects at each shore line with the land sections, which are of reinforced concrete. These land sections extend back from the shore quite a distance before emerging to the surface, in order to make the rise from the level of the river bottom gradual.



Longitudinal Section of Subaqueous Part of Tunnel Floating Section Down the River



Cross Section of Tunnel

One of the two tubes will be used for eastbound traffic, the other for westbound trains. Steam engines will not pass through the tunnel, but the trains will be drawn by electrical engines. This will keep the long tunnel free from smoke and gas. Sidewalks in both tubes allow for the rapid egress of passengers, if for any reason a train should become disabled while crossing the river.

The building of the Detroit river tunnel is one of the brilliant engineering feats of the century and the opening of the big concrete-steel tubes will do away with the use of the cumbersome flatboats on which trains have been ferried across the river for years.

FIGUREHEAD A MONUMENT TO MARINE DISASTER

On the shore at Virginia Beach, Virginia, there stands the figurehead that

Could Tell Many Tales of the Sea

once was the pride of the Norwegian bark "Dictator." For 20 years the figurehead, now weatherworn and scarred, pointed the way through seas in every part of the world, bearing the brunt of many a storm, and now it is a monument to the fate of the ship and her crew. The "Dictator" was driven on the rocks near the beach during a hurricane in March, 1891, and all hands, with the exception of the captain and one sailor, were drowned. The figurehead drifted ashore and was erected as a reminder of the disaster.

HUMAN INSULATOR AMAZES

While telephone men were at work stringing new wires in a town in southern Illinois, one of the wires was dropped across a trolley wire. Among the crowd in the street, frightened by the sparks from the end of the wire, was a man who slightly limped. He approached close to the wire, despite the frantic warnings of the linesmen on the telephone poles, and to their amazement calmly removed the wire from across the trolley.

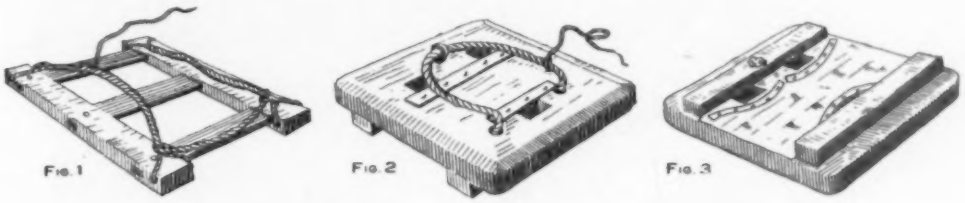
An explanation divulged the fact that he was an old telephone man who had lost one leg in a train accident, and walked with one artificial limb. It also developed that he stood only on one leg while handling the wire.

SNOWSHOES FOR MAN AND HORSE

The ordinary idea of a snowshoe is a light basket-work contrivance of but little weight, but that all snowshoes are not of this nature is clearly illustrated in the accompanying drawings. The first is the crude but effective snowshoe worn by many farmers in Norway, and the second and third drawings are the top and bottom of a snowshoe designed for horses. At times the roads are covered with such heavy falls of snow that progress over them by either man or beast would be very difficult without shoes of this or like nature.

The shoe worn by the farmers is about 12 in. long by 8 in. wide, and consists of five pieces of wood, arranged as shown in the drawing. It is held to the foot by a leather thong, and rope made of twisted birch saplings. The ropes on the side run lengthwise with the foot and are drawn together over the instep by the leather thong, while the rope at the back passes over the heel.

The shoe for horses is about 9½ in. square, and consists of a solid piece of pine. The calks of the horseshoe pass through the three holes cut in the snowshoe, and the rope passes around the hoof, where it is securely fastened by the leather thong. On the bottom of the square of wood are two cleats, provided to keep the horse from slipping. Between these cleats the bottom is covered with a piece of birch bark, inside out, this keeping the snow from sticking to the bottom of the snowshoe.



Norse Snowshoes for Horses and Men

A WILDERNESS OF BEANS

This illustration shows hundreds of piles of beans awaiting shipment at one of the points on the South Manchurian railroad. The fact that the freight cars are of the American type and the bean bags the same as those used for transporting grain in this country makes the scene more American than foreign.

SAVED BY TAR VAT

A vat of tar on the roof of one of the buildings of the Union Iron works in San Francisco, Cal., saved a painter from instant death by providing a soft place for his fall from a height of 65 ft. He was painting a high chimney when one of the ropes of his scaffold broke, dropping him into the vat. The tar, luckily, although not hot, was soft, and he escaped with only superficial injuries. He was removed from the roof to the ground by block and tackle, a somewhat difficult feat as he weighed more than 200 lb.

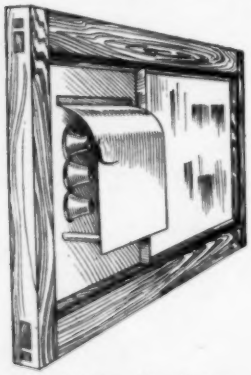
Hundreds of Piles of Beans

Bathtub Sandwichmen

Street Advertising

VENTILATING DEVICE FOR CARS

The ventilating device here illustrated is designed for passenger cars, and is said to provide effective ventilation without drafts. It consists of a cast-iron plate perforated with 18 holes, over each of which is a hollow cone projecting outward. When the train is in motion a partial vacuum is created which pulls the foul air from the car, and which is claimed to prevent any back drafts. A sheet-iron apron is provided to prevent rain or snow from entering the cones.



Railroad Car Ventilator

The illustration gives an outside view of the ventilator installed in a deck sash.

In 21 months 7,714 of the 63,000 employes of the railroads in New York city were injured.

STREET ADVERTISING IN GERMANY

During the fair at Leipzig, Germany, last summer, many novel methods of street advertising were resorted to by merchants and manufacturers. Two very representative examples are shown in the illustrations. The bathtubs are papier maché reproductions of the genuine article. The baby carriage is announced as the "very" latest design.

CHOCOLATE DROPS WITH GERM FILLER

Intentionally filling chocolate drops with a filler of germs, then offering them for sale in the candy stores, would seem an extraordinary procedure to the uninitiated, yet such is now being done in London.

The idea is a British bacteriologist's solution of the problem set by professor Metchnikoff, of the Pasteur institute in Paris, who urged the taking of sour milk or lactic acid for arresting old age, but who omitted to advise how the nauseating effect attendant on the swallowing of the milk could be avoided. Each bonbon is said to con-

tain at least 10,000,000 carefully isolated lactic acid or massol bacilli in the highest state of activity, but the sweetness of the drop offsets nauseation.

Professor Metchnikoff insists that no sooner is the blue massol bacillus of sour milk liberated in the human system than it commences war on the red army of bacillus, or putrefaction microbes. Also, that at the end of a few weeks the swallowing of the amount contained in three bonbons taken daily becomes the undisputed master of the red bacillus.

THE VALUE OF SUNKEN LOGS

The recovery of sunken logs from old, abandoned lumber-mill ponds has become a profitable industry in many parts of the country, especially in some of the timber regions of the South. The fact that timber is not injured by being submerged in water makes the logs obtained from this source just as valuable as newly-cut timber, if not more so. Water-soaked white pine, for instance, is more valuable than newly-felled white pine, even though it has been in the water 25 or 30 years. The action of the water not only preserves the wood, but does its part in seasoning it as well.

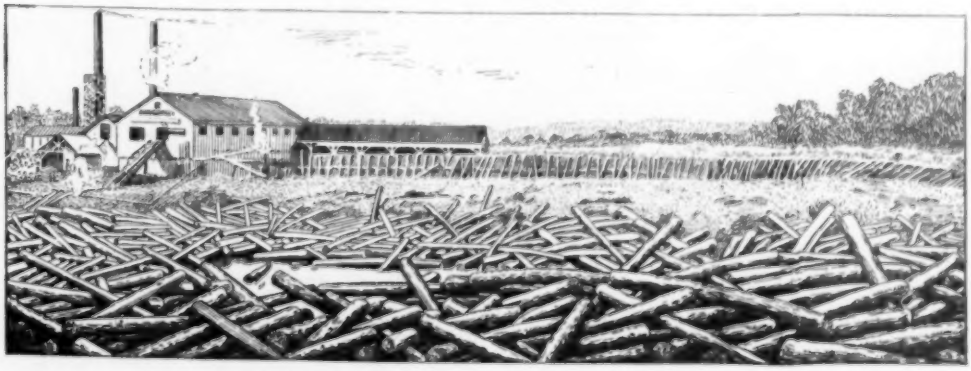
The illustration shows a mill pond recently drained at Grandin, Mo. More than 1,500,000 ft. of logs were recovered, many of which had been at the bottom of the pond for more than 30 years. They were converted into first-class lumber at a big profit.

STILTS AS AGRICULTURAL ACCESSORIES

Many of the hop-growers of Kent, England, use very tall stilts as a means

Stilted Agriculturists

of reaching the tops of their hop-poles, from which they string wires for the hops to climb on. This is done before the plants are grown, and the sight of the stilted workers, walking with long stiff-kneed steps among their forests of poles, reminds one of pantomime giants on the stage.



Sunken Logs More Valuable Than Standing Timber

FERRYBOAT MAKES LONG OCEAN VOYAGE

The fact that the new ferryboat for Havana, Cuba, was built in Liverpool, Eng., instead of the United States, necessitated a long sea voyage over a body of water more turbulent than that for which she was constructed. Consequently, her sides had to be strongly boarded up to keep any sea she might meet from gaining admittance and at least tearing away her deckhouses if not sending her to the bottom. Her appearance, prepared to cross the ocean, was not unlike that of a floating barn.

Ferryboat Prepared for Ocean Voyage

The "Guanabacoa," for such she is when her disguise is removed, is 140 ft. long, and has a beam of 55 ft.

REDWOOD LOG BENCHES

In what is known as the Bohemian grove in the California redwood forests is an open space around which is grouped a dozen great redwood benches like the one shown in the illustration. Upon these the members of the Bohemian club of San Francisco sit during summer nights and sing and tell stories, while in the center a great camp fire burns.

Comfortable and Solid Redwood Benches

These benches, the most comfortable that can be imagined, are cut from 16-ft. sections of a monster redwood. The log to the right of the illustration has yet to be converted into a bench.

COMPARISON OF OLD AND NEW VIOLINS

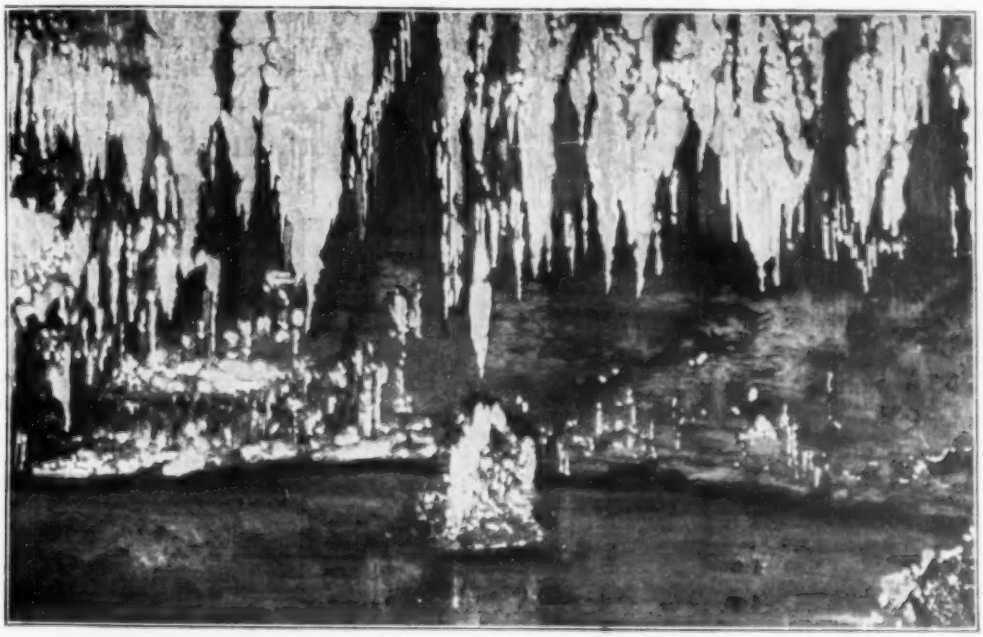
An ingenious test of old and new violins, in which an instrument of modern make was voted the finest, was recently held in Paris. During the performance both critics and performers were in complete darkness, so that it was impossible to see which one of the seven violins selected for the test was being played. Then, immediately after being used, the instrument was placed under a cloth and the lights were turned on for a few mo-

ments to enable the critics to write down the votes.

All the violins were played by two musicians of high standing, and the compositions were written especially for the test. The two violinists tried to bring out the best in each violin, and the result, as decided by the votes, was interesting. The modern make of violin led the list with 102 votes, and its nearest rival for favor was a Stradivarius with 96 votes. Other old and famous makes of violins received 92, 85, 83, 82, and 80 votes.

THE INCLOSING OF STAMPS

In inclosing stamps in a letter, the stamp, if possible, should always be one from the outside rows of a sheet, which provides a blank margin that can be used for the sticking. This leaves the stamp proper free and does away with the possibility of its being spoiled. But if a stamp from the outside row is not available, it is preferable to stick the stamp to the letter at its center instead of by the edge. By wetting the stamp in a tiny space in the center it is easily stuck to the paper, and as easily removed. Yet, when it is used, all the edges have sufficient gum to stick closely and the little ungummed space in the center does not show.



Stalactite Cave in Bermuda

BERMUDA'S BEAUTIFUL CAVES

The cave shown in this illustration is one of the most beautiful of the many in Bermuda. It is a circular grotto covering an area of nearly half an acre, with groups of beautifully wrought natural pillars around the sides. These support the roof, from which hang exquisite stalactites of snowy whiteness. In the center is a pool of water ranging from 20 to 30 ft. deep and as clear as crystal. From the center of this rises a natural stalagmite island.

The one-eyed person can tell what objects are far and which are near, by the fact that those in front hide those which are in the rear, but according to the Optical Journal, to him all nature is a picture in the flat, just as is a scene in a painting.

SPECIAL PLATES FOR BABIES

The baby, for its first few years at the table, is responsible for innumerable broken plates, and soiled tablecloths. The responsibility of the former is due to the fact that the ordinary plate is made in such a way that the tiny fingers can get under the rims and lift them, while the soiled linen is often due to the fact that the baby has difficulty in getting its food onto the spoon, and usually pushes much of it off the plate.

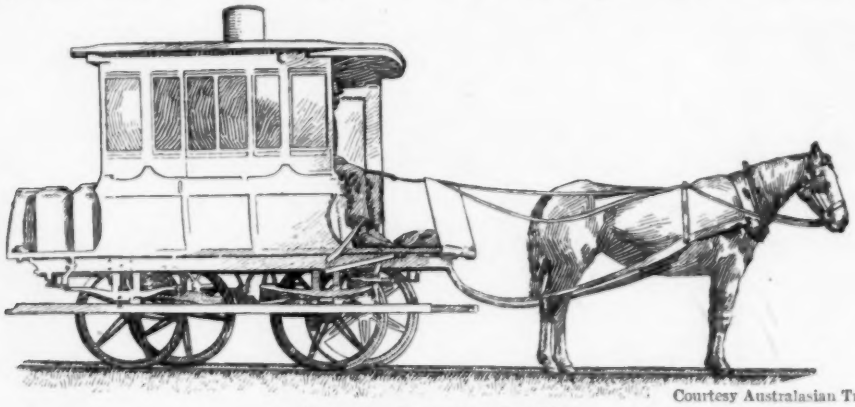
Special Plate for Baby's Use

These conditions are overcome by the specially designed baby plate shown in this illustration, and in addition they teach the baby how to use its spoon. The plate weighs 20 oz. and is made heavy to give long service without breaking, and the bottom is perfectly flat so that the fingers cannot find a hold underneath. The most interesting feature, however, is the rim overlapping the concave center, which forces the food on the spoon the instant it comes in contact with it. The outer rim prevents the food from being spilled on the table.

The plates are made in 12 different designs, all of which are appropriate for children. Their diameter is 8½ in.

BUSH TRANSIT IN SOUTHERN AUSTRALIA

In the days of the horse-drawn street car many an American city of 10,000 or 15,000 population considered itself distinguished by such a line, and an unsettled country district never dreamed of such a convenience. In this, Australia is showing America a lesson by running a horse car, or "tram" as it is called in England and her colonies, a distance of 20 miles through the bush, between Pt. Broughton and Mundoora in Southern Australia. It is a government operated project and has proven a great convenience to the people in the district.



Courtesy Australasian Traveler

Australian Interurban Car Line

SHOP NOTES

How to Make a Concrete Garden Vase

Few people realize that anything of an artistic nature can be made from cement. Concrete is generally looked upon as a material fit for only heavy work and so little seems to be known that it has unlimited possibilities of artistic treatment.

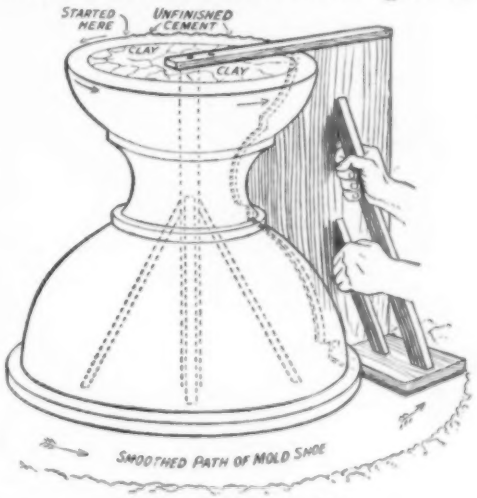
The concrete garden vase as illustrated shows how easily ornamental designs of this nature may be worked out, and such a completed article will cost very little for the materials. A vase of this kind can be made with a half form cut from sheet metal and fastened to a wood base to which is attached an arm for the radius to describe a circle, and a sliding shoe securely nailed to the bottom.

The first thing to do is to lay out one-half of the design intended for the vase on cardboard, then cut out to the line for your pattern. Lay this pattern on a piece of sheet metal, about 28 gauge, and mark out the design and cut the metal on the mark with tinner's shears. Mark out the same design on a wide board that is 1 or 1¼ in. thick and cut out the wood with a keyhole saw. Lay the metal on the board, allowing the form side to project over the edge of the wood about ¼ in., and tack all around with 1-in. brads. Bevel off the wood with a wood rasp for clearance, so the sharp edge will be free to cut the cement clean.

Mount the board with the metal face on a bottom board placed at right angles, which is used for a shoe. This shoe should be shod with a piece of sheet metal so it will slide around easily. Two braces are attached to the back of the board and on the top of the shoe.

The arm must be securely fastened to the top edge of the board, and have sufficient length to reach over to the center of the intended size of the vase.

A standard for the center of the vase shown by the dotted lines in the sketch is well braced and staked to the ground



Forming the Concrete Vase

where the finished vase is to remain. Clay is made plastic by adding water and then it is built up around the stake in a form near the shape of the finished vase. The arm of the former is now fastened to the top of the center stake with a large wood screw. The hole through the arm should fit the body of the screw a little loosely so the form can be turned easily. Take hold of the braces as shown and push the former around in a circle and cut off the surplus clay. There may be some holes left from the first cutting, which can be filled up and the former run around for a finishing cut. When this is complete, remove the screw and set the former out for a distance equal to the desired thickness of the concrete.

Mix your concrete, making it rather thick and plastic, using two parts sand and one part cement, and put a coat of this on over the clay form. Take hold of the braces as before and form the

concrete the same as you did for the clay, remove the former and give the outside surface two or three thin washes of neat cement. When the cement has set, the clay can be removed and soil put in its place.

In forming vases, bases, columns, etc., always have the largest or heaviest part down. This will make it easy to remove the clay core without the danger of cracking the concrete.—Contributed by W. A. Lane, El Paso, Tex.

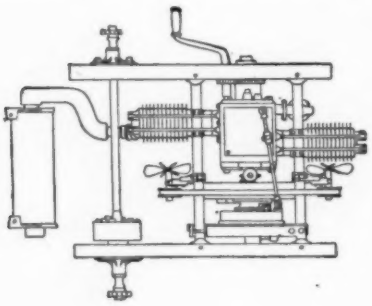


FIG. 1
The Engine

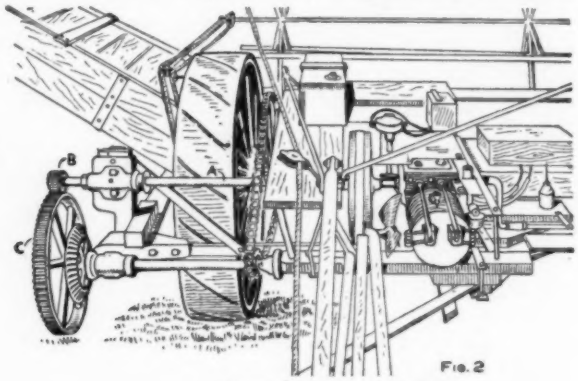


FIG. 2
Engine Attached to Binder

Home-Made Motor-Driven Harvester

The owners of a Colorado ranch desired to change the motive power of their 14-ft. cut header and binder and a 16-year-old boy successfully attached a 14-hp. air-cooled four-cycle gas engine to take the place of the horses. The engine was taken from a farm auto buggy and the cost of the change, outside of labor, did not exceed $7.

The engine, as illustrated by the line drawing, Fig. 1, was attached on the pushpole behind the header or binder and in front of the driver, as shown in Fig. 2. The transmission gear was removed and the countershaft, A, placed in its stead, and the speed reduced and transmitted to the machine by the small pinion B and gear C. The large chain from this shaft revolves the drive wheel of the harvester.

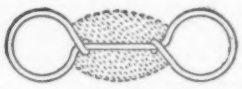
The operation was entirely successful and satisfactory and 35 to 40 acres of grain was cut each day with a fuel consumption of 8 or 10 gal. of gasoline. The machine would travel at a greater speed than horses could walk. The harvester proved to be only half a load for the engine.—Contributed by R. B. White, Denver, Colo.

How to Obtain Cheap Dry Batteries

Not very many people realize that good serviceable dry cells can be obtained from an automobile garage very cheap. These cells having been "run out" beyond the required number of amperes for automobile use, will give excellent service, considering their cost. Many of them will give two-thirds of their original amperage. Six of such cells have been in use on my door-bell circuit for nearly a year.—Contributed by H. H. Cutter.

A Wire Chalkline Holder

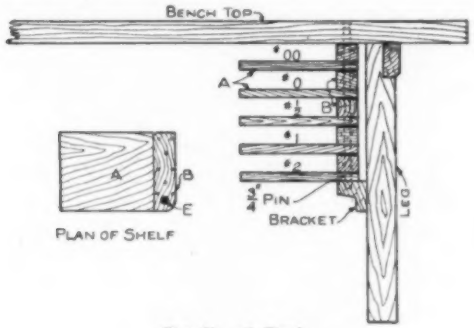
Anyone using a chalkline will appreciate the value of this simple line holder. It can be made of No. 9 or 10 gauge copper or soft steel wire in any length to suit the length of line. The line can be fastened at



any part of the metal between the two rings or at either end, and after the line is wound up the loose end can be fastened to prevent it from unwinding in the tool bag or kit. The accompanying sketch shows how the wire is bent and where the line is wound upon it.—Contributed by Geo. M. Mock, Buffalo, N. Y.

A Sandpaper Rack

Most every woodworker who works at a bench has several different grades of sandpaper that he is constantly using for different things, and unless he has a special place to keep them, the sheets will get badly mixed and mussed up. For workmen who have not already provided themselves with a suitable place to keep their paper, the little device shown in the accompanying sketch will prove interesting. It can be made by any workman in a very short time and it will soon pay for itself, by the time and labor it saves when one wishes a piece of paper. It is placed under the bench and is out of the way when not in use.

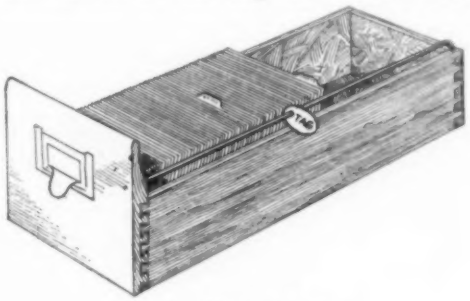


Details of Rack

The boards A are the length of the sandpaper plus 2½ in., and ½ in. wider than the paper. The batten pieces are 2 by 2½ in. and are attached to the board as shown at B. E is a ¾-in. hole through which a ¾-in. pin passes. Any number of boards can be used and the design can be varied to suit the bench and the one making it. The sandpaper is tacked to the board near block B and when a piece is wanted, the proper board is swung out and the paper is torn off.—M. E. D.

Marker for a Card Index

The place for a card taken from an index tray is not quickly found and for this reason the marker was made as shown in the illustration. This marking device can be put on any index tray by drilling two holes in the tray, one in the front board and one in the rear end of the side piece. Put a small aluminum or tin tag on a wire and



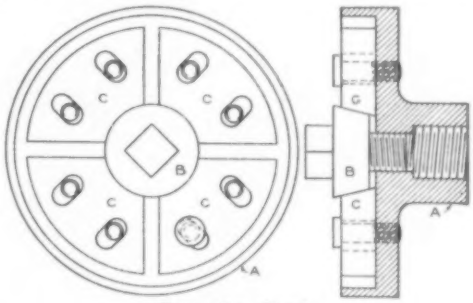
The Tag Marks the Place

place the wire in the holes as shown. When a card is taken from the tray, drop the tag in its place. The card then can be quickly replaced.—Contributed by Charles F. Weil, Chicago, Illinois.

Expansion Chuck

The accompanying sketch shows a design of an expansion chuck which will be found a very useful tool for holding piston rings and similar work while they are being faced off in the lathe.

The chuck proper, A, is made of cast iron. It is tapped out to screw on the lathe spindle. B is a screw with a taper shank which acts as a wedge to force the jaws C into contact with the ring. The jaws are held in place by tap bolts which are tapped into the piece A. They have slotted holes in

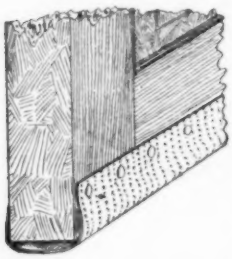


Expansion Chuck

them as shown in sketch so as to be adjustable.—Contributed by Wm. F. Arzinger, Jersey City, N. J.

Weather Strip for Inside Doors

A door swinging high enough to be free from rubbing a carpet or rug, will admit considerable cold air at the bottom. A weather strip that will wear for one season can be made from a newspaper or heavy wrapping paper placed over the lower end of the door and tacked on both sides as shown in the sketch. The paper will pass over uneven surfaces, edges of rugs, etc., without catching.—Contributed by W. A. Humphrey, Columbus, O.



Dressing Stone-Cutters' Tools

A practical way to dress stone-cutters' tools is as follows: For tooth chisels first forge out to the required thickness, which is determined by the hardness of the stone to be cut. It must be borne in mind that a tool forged and tempered to cut sandstone would not do for granite or oölite limestone, so the smith must determine what style of tool is required, then forge to suit the class of work, says the American Blacksmith. For very hard granite a tooth chisel should be made rather heavy with teeth cut as shown in Fig. 1. The teeth for cutting sandstone are also left heavy, but not sharp, as shown in Fig. 2. For oölite limestone and soft marble the tool is about the usual shape, Fig. 3.

Several cutters are made as shown in Fig. 5 for cutting out the metal between the teeth. These should be forged with plenty of clearance, so they will not stick. Use heavy oil to cool the cutters when cutting a tooth. Have the oil near at hand and keep the supply cutters in it. Space the blank tool with a small three-cornered file, as this will serve as a guide when the metal is hot. If possible, forge a large number of tools at a time, as you can get along so much faster with each operation. The blanks spaced should look like the sketch Fig. 4. The cutting operation will force the edges out to the dotted lines.

Put several blanks in the fire and heat slowly and keep them just hot enough to keep you busy cutting. A hot blank is taken from the fire and placed in the vise and the teeth cut with a cutter, driving it with a light hammer. After all the teeth have been cut, dress up the tool on the emery wheel and then finish each tooth with a small knife file to the required shape.

Burning a Wire Cable in Two

When an iron or steel cable is cut, the ends will untwist and spread out unless the part is well wrapped with wire on each side of where the cut is

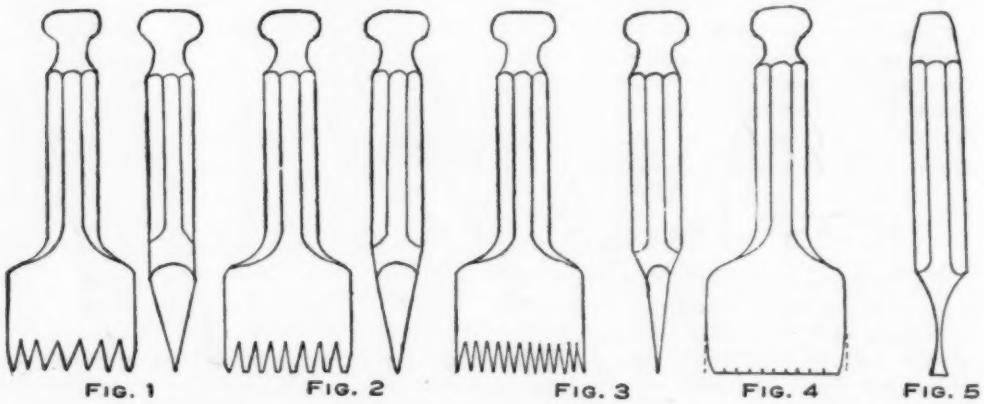


FIG. 1 FIG. 2 FIG. 3 FIG. 4 FIG. 5

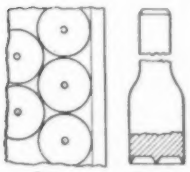
Designs of Stone Cutter's Tools

to be made. The quickest and best way to cut a cable, and one that will not require any wrapping with wire is to place it in the forge fire and burn the strands in two. Almost any size or kind of hoisting cable may be easily separated by this method.

First mark the place to be cut and hold the cable in your fire until there is a shower of sparks thrown off. Begin pulling on both parts of the cable at this time and when it is heated to a welding heat give the parts a good hard twist in the direction of the strands. This will pull the cable apart where it is heated, leaving the wires at each end all welded together and tapering down to a smooth point. Such an end does not need any wrapping to keep the wires that form the cable from coming apart.—Contributed by A. D. Wagner, Vancouver, Wash.

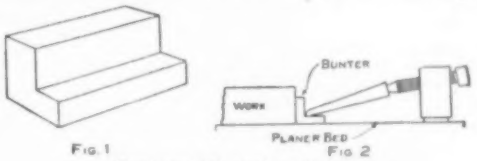
A Diemakers' Punch

In blocking out a die it is always necessary to lay out the holes very carefully so that there will remain but very little bridge between each hole after drilling. This is a very tedious job on a large die unless done by a punch as is here illustrated. The punch is made of tool steel, which is turned up on a lathe to the proper size and shape, then hardened. By placing the punch upon the die and giving it a sharp tap with a hammer you scribe a circle, as well as make the center mark. Mark off the required number of circles and enlarge the center marks with a center punch before drilling.—Contributed by Chas. E. Klink, Lemoyne, Pa.



A Tool for Holding Work on a Planer Bed

The accompanying sketch shows a handy little attachment for holding work on a planer bed and is called a bunter. Its object is to prevent denting finished sides of that class of work that must ordinarily be held by toe dogs or fingers. Two or more of these bunters can be used on a job and they



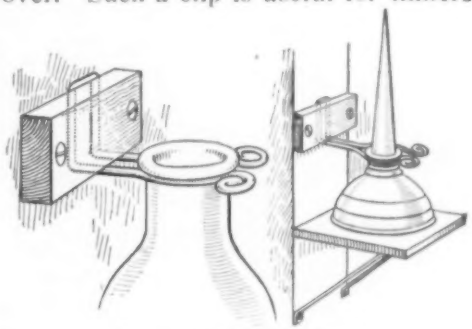
Tool and Method of Using

can be made with one low side, as in Fig. 1, or both sides alike, as in Fig. 2, or in any other form to suit individual cases; a single milling cut over a strip of steel being the only machine work necessary. When made of good steel and hardened they are practically indestructible.

They are very convenient to use in front of a dog that would come directly over a slot or post hole in the table as a bunter here interposed bridges the gap quickly and securely.—Contributed by Donald A. Hampson, Middletown, New York.

Clips for Holding Bottles and Oil Cans

A piece of ordinary wire, about No. 12 gauge, bent in the shape shown in the illustration and fastened to the wall with a couple of screws will make a handy clip for holding a bottle or an oil can. This device fastened in a tool box of an automobile, using the bottom in the place of a shelf will hold the oil can and prevent its being turned over. Such a clip is useful for tinners

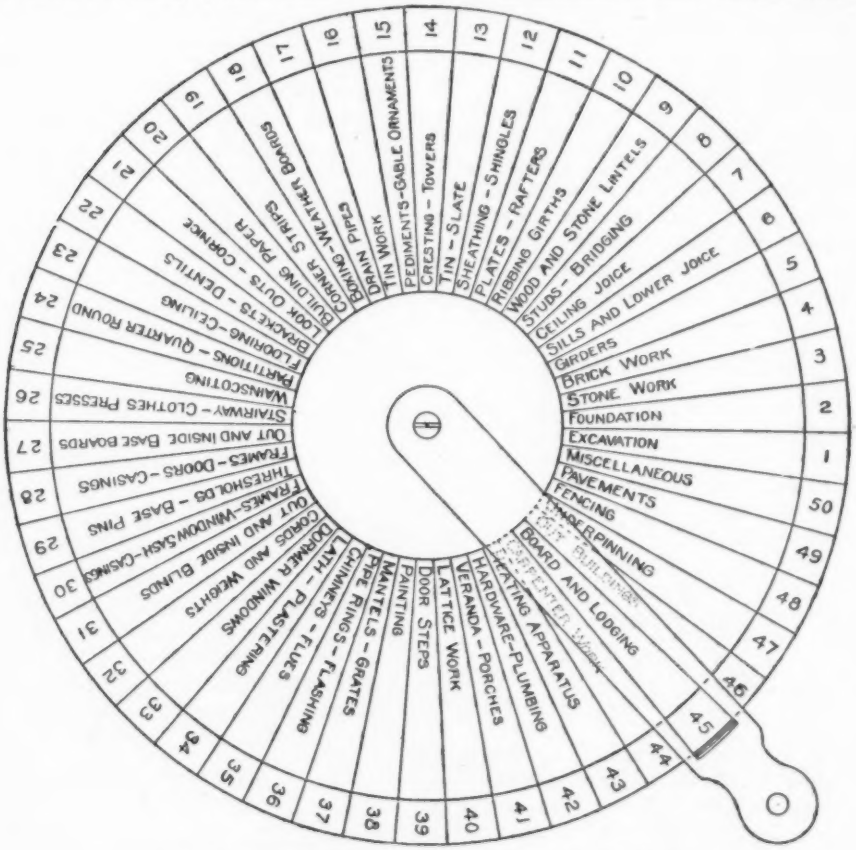


Bottle and Oil Can Holders

to hold the acid bottle in a handy place and keep it off the bench.—Contributed by Don C. Higbee, S. Omaha, Neb.

Handy Contractor's Estimating Wheel

In estimating the cost of materials for the construction of a building mistakes are liable to occur and many times certain things are entirely overlooked and not included in the total amount of your bid for completing the building as called for in the contract. I have used for many years what I call an "estimating wheel" to eliminate any errors of omission in making estimates on buildings of all kinds.



Taking the Numbers Successively No Part Will Be Missed

Commencing at number 1, "excavating," as shown in the illustration, and moving the handle successively on each number to the number 50, "miscellaneous," everything that is used in the building of an ordinary house has been called to mind.

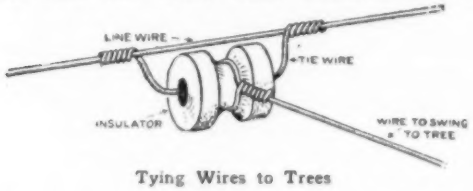
The wheel is made of a wooden disk, 8 in. in diameter and ¼ in. thick, on which is pasted the estimating index as shown in the sketch. The handle or indicator is made of galvanized iron cut out as shown and pivoted in the center of the wheel with a rivet or screw for the axle so it can be easily turned around to the various numbers, the part on which work is being done showing through the slot in the indicator.

On the reverse side of the wheel are pasted rules and formulas with illustrations showing the various cuts and bevels of rafters, rules for estimating brick in walls, chimneys, flues and pavements, for estimating stone work, number of nails to the pound and the amount to use in various kinds of

work; strength of timbers and many other useful notes on making estimates. —Contributed by T. T. Templin, Paris, Kentucky.

Single Telephone Wire Hung from a Tree

Should it be necessary to run a single telephone wire through woods and swamps, swing the line to trees with the hanger as shown in the sketch. This will save many poles from being placed where possibly it would be hard to keep them standing, especially in swamps, says Telephony. Be careful to so run the wire that branches and



Tying Wires to Trees

leaves cannot even touch it when they swing in the wind.

How to Fasten Rubber to Metal

Rubber matting used in automobiles can be secured to a metal surface by using a cement made of flake shellac dissolved in alcohol to form a thick syrup. Several thin coats carefully applied should be given to each surface, each subsequent coat to be applied before the last is dry. Press the rubber upon the coated metal, taking care to have all of the surface in contact, and by the use of a board and rather heavy weights, keep the surfaces pressed together for about 24 hours.

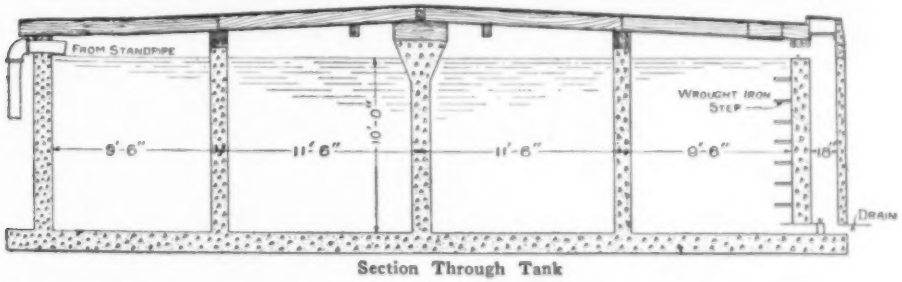
A Reinforced Concrete Reservoir

Concrete is fast coming to the front as a material for reservoir and similar construction. It is admirably adapted

Tank as It Appeared Without Top

for this work in view of its durability and permanency. It is rustproof, and has proven itself time and again a reliable and economical material for this class of construction. The cost is a feature which brings it easily within the reach of municipalities sufficiently large to install a waterworks system. The accompanying sketches taken from the Canadian Cement and Concrete Review are of a concrete reservoir recently constructed at Palmerston, Ont. The one sketch shows the tank as it appeared at the time of testing and before the roof was put on.

This reservoir has a diameter of 42 ft. and is 10 ft. deep with a capacity of 103,435 U. S. gallons. The walls are 12 in. thick and the roof supports 10 by 10 in. concrete posts. The horizontal wall reinforcement consists of ¾-in. cup bars placed 8, 12 and 16 in., center to center. The vertical wall reinforcement consists of ¾-in. cup bars placed 24 in., center to center. The columns for roof support are reinforced with four ½-in. cup bars, 12 in. long. Timber was used in the roof construction and is double-boarded to keep out the frost during the winter season.



Section Through Tank

Home-Made Broom Holder

In all well regulated households there is usually found a place for the broom, duster, dustpan and carpet

Holder for the Cleaning Utensils

beater. As these four articles have to do with the cleaning of the floors and furniture they should be kept in one place as convenient as possible. The accompanying sketch shows a holder that will provide a place for each one of these articles and keep them where they may be found when wanted.

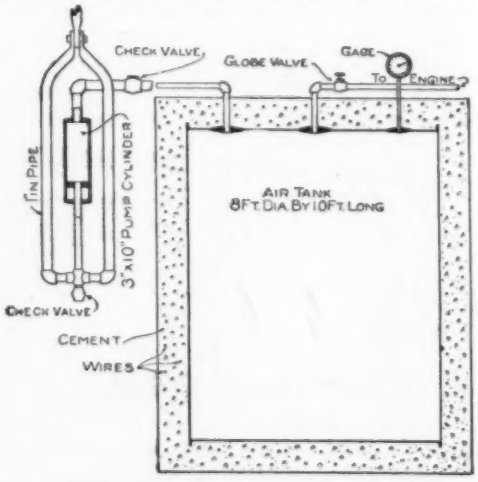
The holder is made from a board 1 in. thick, about 3 in. wide and 14 in. long. The ends are cut down so as to make them 1 in. square, leaving the center full width of the board with a notch cut in it to receive the broom handle. Two shoulder hooks are screwed into the outside edge of the wood, one at each end to make places to hang the duster and carpet beater. A plate hook turned into the underside of the wood and behind the broom handle makes a place for the dustpan. The wood is fastened to the wall with two nails or wood screws.—Contributed by Robert F. Washer, Sandy Hill, New York.

Steady Power Obtained From Compressed Air Pumped by a Windmill

There are some tools in nearly every blacksmith shop, no matter how small, that require a steady power of some kind or other to run. I had a small steam engine in my shop for a while, but soon found that I did not use it enough to pay me to keep up steam.

I then built myself a windmill, thinking that it would be cheaper than a gas engine, but the power it gave would not run the tools at a steady speed. The accompanying sketch shows how I finally won out and used both my windmill and steam engine.

I constructed an air pump which worked similar to an ordinary bicycle pump. Having a 3 by 10-in. pump cylinder on hand I made a piston for it, using a 1-in. gas pipe for a rod and a leather washer held between two flanges on one end of the rod for a plunger head. On the other end of the rod I screwed a 4-way pipe coupling and into this a nipple and vertical check valve as shown in the sketch. I then connected two upright pipes to the side openings of the 4-way coupling by means of elbows and nipples. The nipples I filled with lead in order to make



Details of Pump and Tank Construction

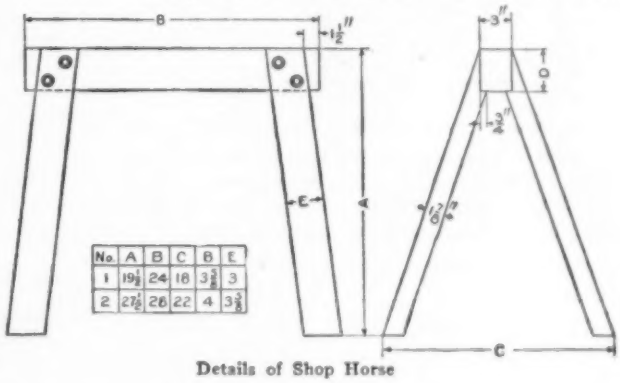
them air-tight. The upright pipes are bent together at the top and flattened

so as to make a connection for the pump rod of the windmill. On the top end of the cylinder is attached a pipe, with a check valve in it, and connected to a large air tank which I had a tinner make of heavy galvanized sheet iron. The tank is 8 ft. in diameter and 10 ft. long and is reinforced with concrete and heavy wire. A pipe line with a globe valve in it connects the tank to the engine. A gauge is also attached to register the air pressure. The pipes are fastened to the tank with heavy flanges.

The windmill which I made myself has a 16-ft. wheel and develops power enough to put 80 lb. air pressure in the tank and that pressure easily runs my 3-hp. steam engine. The tank fills about as fast as I use the air, thus I am able to run my engine for several hours at a time with practically no cost at all. The engine is well packed so as to utilize all the air with as little waste as possible.—Contributed by C. L. Perrin, Kerkhoven, Minn.

Design of a Shop Horse

Most machine shops have use for two or more shop horses, but if they are not well built and solid they are worse than none at all. The accompanying sketch and table gives the design and sizes of two different ones that will be found to be about right. Any mechanic can make them in a short time, care being taken to get the joints a good fit as this is what makes them stiff and solid when they are finished. Three-eighths inch carriage bolts should be used to bolt them together. Oak is the best wood to use and usually enough scrap pieces can be found about the shop to answer the purpose.—Contributed by Urban A. Towle, St. Albans, Vt.



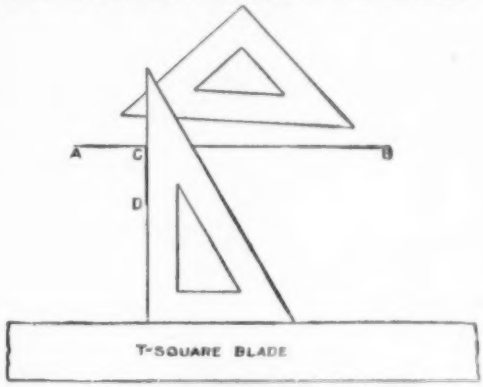
No.	A	B	C	B	E
1	19½	24	18	3⅜	3
2	27⅛	26	22	4	3⅜

Details of Shop Horse

A good hard cement is made of 16 oz. fine cast-iron turnings and 1 oz. of sal ammoniac.

To Avoid Blotting Fresh Ink Lines

It sometimes becomes necessary for the draftsman to draw short vertical lines before the horizontal ink lines are

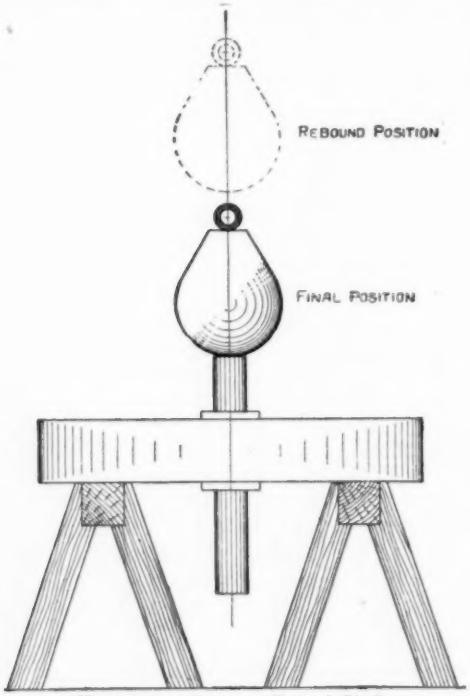


Position of Triangles

dry, and it is impossible to lay the triangle on them without causing a blot. The lines can often be drawn by laying one triangle over the other, says Machinery, to lift it off the paper, as shown in the sketch, when the line AB is supposed to be a freshly inked line, and it is desired to draw line CD without waiting for AB to dry. One triangle can be laid on the board just above A B with one edge approximately parallel to it. Then the upper end of another triangle can be laid over the first, its lower edge being guided by the T-square blade in the usual way. This lifts it clear of the line AB, and CD can be drawn just about as well as though the triangle were flat on the paper.

An Unusual Balancing of a Heavy Hammer When Dropped

In trying to drive a 6-in. shaft out of an old fly-wheel in the scrap yard of a foundry, a 1,200-lb. hammer was



Hammer at Rest on End of Shaft

dropped a distance of 20 ft. on the end of the shaft, rebounded, struck again, and rested there as shown in the accompanying sketch.—Contributed by Frank Hargroove, Columbus, Ohio.

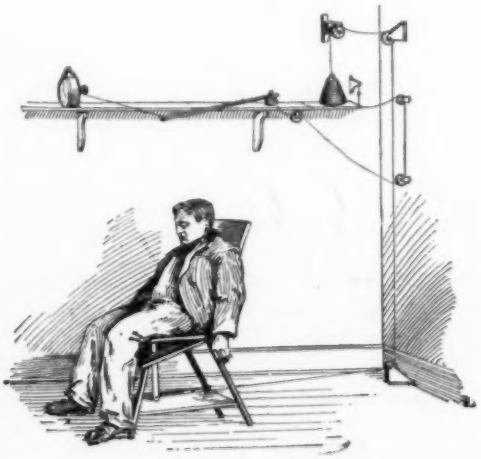
An "Alarm" Chair for the Engineer

Once I was night engineer of a small electric railway power station. The station was as neat a little plant as you could ever find and she ran like a dream, says a correspondent of Electric Traction Weekly. My shift was a fluctuating period depending on what time Bill the day man showed up, and Bill's hour for rising was dependent upon a number of variable quantities as well as qualities. But usually I did from 14 to 16 hours at a stretch. As I was the only man around the plant during the night shift and the plant was way out in the country, I used to get pretty lonely along about 2 o'clock in the morning. We had the plant in such apple-pie order that there really wasn't anything for the night engineer to do except to make the rounds every half hour or so, feel of the bearings, look at the gage glasses and maybe pour a little oil into the oil cups.

Many a night I longed to tip back in my chair, put my feet on the desk and take about 40 winks, but my conscience wouldn't let me. I am one of those mortals that don't do things by halves, so when I sleep I do it right and I knew if I ever did get sound asleep Mount Vesuvius might go off in that engine room and I wouldn't know the difference. The alarm on an ordinary alarm clock only soothes me into a deeper sleep.

Well, one night when I was whittling a tooth pick out of a broomstick handle to keep awake I got to thinking harder than ever how nice it would be to put my head back and get a 30-minute snooze if I could only devise some means for waking myself up in time to ring in that infernal watchman's clock on the next round.

All of a sudden I had an idea but I didn't faint. I just reached for my pencil and worked the idea out. Then I got the cord and the fixings and put it together and it worked like a heaven-



Drops the Sleeper to the Floor

sent blessing. The sketch will show the idea and all its details.

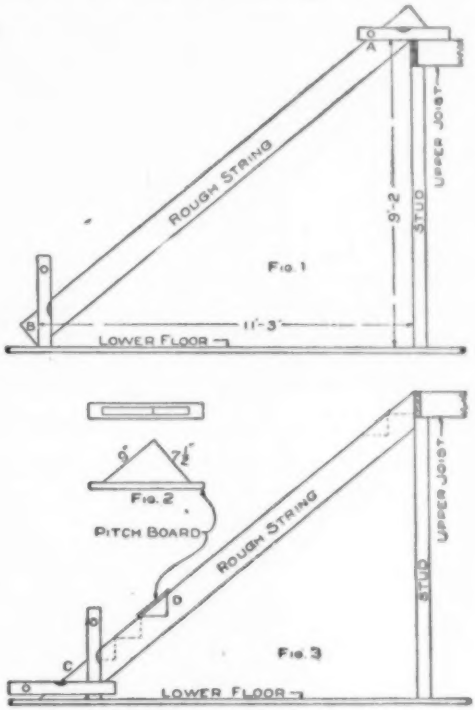
I took the alarm clock and attached a spool to the spindle that wound up the alarm spring. The clock I fastened down to a shelf with a strap. Then I arranged a lever as shown, one end of the lever being attached to a string that was fastened to the spool on the alarm clock spindle, so that when the alarm went off, the spool would revolve and wind up the string and this would pull the lever. This would knock off a 2-lb. weight which in falling from the shelf would jerk out a book that held up the hinged end of the shelf on which rested a 25-lb. weight. This would let the heavy weight drop, thereby jerking out the prop from the seat of the night engineer's chair, and the said night engineer would find himself sitting up straight, rubbing his eyes and wondering what happened.

Some of your readers may smile when they see this, but nevertheless this little "stunt" insured the writer many a much-needed nap without fear of oversleeping and neglecting his duties. By setting the alarm for the desired hour the chair would "work" at just the right moment to awaken me in time to make my rounds.

Short Cuts in Stair Work

A short and simple method of laying out stair stringers for a plain, straight flight of stairs is shown in the accompanying sketches. The lengths and cuts are secured by using the plumb and level at each end of the string, as shown in Fig. 1, and scribing as at A and B, says a correspondent of the American Carpenter and Builder. Then, by changing the string end for end, it will fit as shown in Fig. 2.

Next find out what rise you want. This depends on the space you have, but if there is sufficient room, the steps should be laid out with a 7 or 7½-in. rise. Suppose the height between the floors is 9 ft. 2 in., or 110 in. Dividing this by 7, we have 15 5/7 or 15 spaces, and by dividing 110 by 15, we have the exact rise which is 7 1/3 in. If there is plenty of room on the floor for the run, the tread can be made any chosen width. Suppose 9 in. is the desired width. By multiplying 15 by 9 we get the run on the floor, 11 ft. 3 in. The lower end of the string should be



Method of Laying Out Stair String

placed at this point as shown in Fig. 1. Then proceed, as already stated, with the plumb and level.

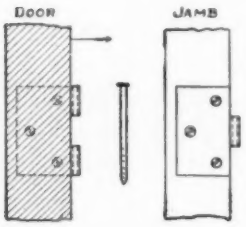
After obtaining these cuts, next divide the string into 15 equal spaces with a pair of dividers and again use the plumb and level in laying off the first notch as shown at C in Fig. 3. Carefully cut this out and use the piece for the pitch board, shown in Fig. 2. This is used to lay off the rest of the string as shown at D, Fig. 2.

Prussian blue and Chinese blue are both the same chemically but they do not cut or look the same.

When using dry cells in a damp place put them in a tight box and pour melted paraffine around them.

A Handy Door Lock

A very serviceable inside lock for doors can be made from a common door hinge by fitting it to the door and jamb as shown in the accompanying sketch. It is best to file down the bar which connects the hinge to make it move in and out more freely. When the door is to be locked, simply close it and drop a nail into the place where the pin of the hinge has been removed. This will be found a very handy and strong lock to be used in place of a bolt and it is much cheaper.—Contributed by F. G. Feeney, Chicago, Ill.

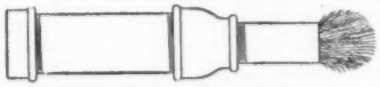


Dredging a Channel

A family of fishermen living on a sandy beach on the shore of Lake Erie built a steam fishing tug in their back yard. They were laughed at for building a boat which they could not launch. The brothers, however, were silent and kept at their work. At last the boat was completed and moved to the water's edge where it rested on the ways. On the day set for launching the skeptics were on hand to watch the proceedings. A fishing tug was seen coming along shore and when it reached a point opposite the newly completed boat, a man came ashore in a row boat towing a heavy hawser. As soon as he beached his boat, he placed a loop of the hawser over a post on the shore and the tug immediately put a strain on the hawser. After fifteen minutes of furious steaming at a standstill the bystanders were surprised to see the tug back in a short distance toward the shore and repeat the operation. Fifteen minutes later she again backed up, and at intervals she continued to back up until finally after four hours the tug floated where the day before there was a depth of but 3 ft. Then she steamed out to sea through the channel which the screw propeller had literally "fanned" out of the sand. The lines were cut, the new tug slid down the ways and the skeptics drifted away as she struck the water.—Contributed by J. E. O'Brien, Buffalo, N. Y.

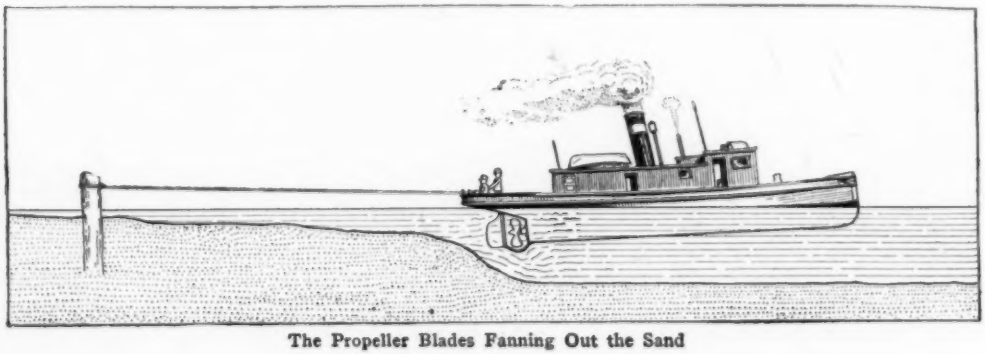
A Home-Made Torch

Here is shown a design of a home-made torch which has proven to be a success. Secure a piece of ordinary



Torch Made of Pipe Fittings

1½-in. gas pipe about 6 in. long and thread both ends. Screw a cap on one end and a 1½ by 1-in. pipe reducer on the other. Then a 1-in. pipe nipple about 3 in. long is threaded on one end and screwed into the 1-in. opening in the reducer. The nipple should be filed out smooth on the inside so the wick



The Propeller Blades Fanning Out the Sand

will pass through easily. The wick is made of cotton wrapping string which has been doubled several times. Coal oil can be burned in the torch but lard oil makes a better light and does not give off any obnoxious odors. This will prove to be a very handy torch for night watchmen and others who have to go into dark places.—Contributed by P. Wright, Santa Clara, Cal.

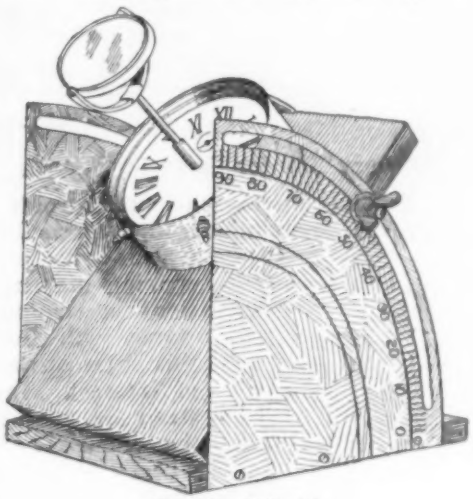
A Home-Made Heliostat

It is not always convenient to point a spectroscope to the sun, and if one did, the apparent motion of the latter soon necessitates the shifting of the instrument. This may be remedied to some extent by mounting a small hand mirror centrally on a ball and socket joint, so that it can be adjusted in all directions, says The Photographic Journal, England. With such an arrangement it is possible to direct the sunlight on a slit long enough to obtain excellent spectra, particularly when a wide slit is used.

For advanced work in the study of the solar spectrum a good heliostat is a necessity, but even the photographer who uses his spectrograph not only for the testing of plates and filters, but also for the occasional study of line spectra, will find such an instrument of great assistance.

Commercial heliostats are somewhat expensive, but quite an efficient instrument can be made in the following manner: To a wood base, about ½ by 6 by 12 in., is hinged a slightly smaller board, and in this board is cut a circular hole to a depth of ¼ in., large enough in circumference to take an alarm clock. Two quadrants of brass are nailed to the sides of the base, one of which is divided by means of a protractor into degrees and half degrees. A slot is cut out near the edge of each quadrant for two bolts with wing nuts to pass through for adjustment of the upper board to any angle.

The hands of the clock must be removed and an extra train of three wheels put in so that the center pinion revolves once in 24 hours. This part of the work can be done by a local jeweler that repairs watches and clocks. The center pinion is replaced by a



Complete Heliostat

small brass tube with a little screw having a milled head at the upper end. The mirror used in the making of this particular heliostat was one discarded from a microscope which had one side plane and the other concave. The original semicircular arms were retained, but filed down so as to reduce weight, an important point, considering the driving power of the clock. The supporting rod was made of aluminum.

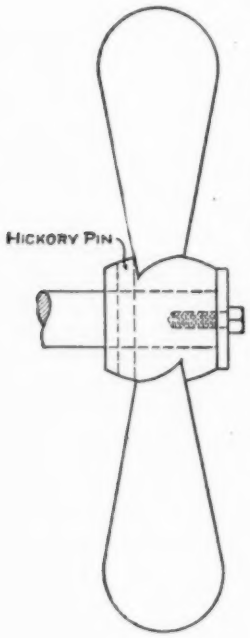
To use the heliostat the base is placed with its length accurately north and south, that is pointing directly at the sun at noon, and the upper board is inclined at an angle equal to 90 deg. less the latitude of the place of working. The mirror is then turned so as to face the sun, which should reflect the light in a line with its axle.

Sometimes it may be found inconvenient to place the spectroscope in the path of the reflected beam and then a supplementary mirror may be brought into play. Either the concave or plane mirror may be used, but with the former the focus is so short that the slit must be within a few inches of the mirror. With the plane mirror in use the heliostat may be a long way from the spectroscope.

The only other accessory which is useful with the heliostat is a condenser. If the plane mirror be used, the beam of sunlight considerably more than covers the slit, whereas if the image of the sun be formed by the concave mirror on the slit, it will be so small as to form but a brilliant stripe down the center of the spectrum with a fainter spectrum on each side. In nearly all cases, therefore, it is advisable to use the plane mirror and a condenser so adjusted as to completely fill the slit in the light.

Hickory Key for Propeller Wheels

Launch owners who have trouble with the breaking of their propeller wheels due to striking obstructions in shallow water, will find this little device of interest. Instead of keying the propeller wheel to the shaft in the ordinary way, drill a hole through the hub of the wheel and the shaft and drive a hickory pin in it as shown in the accompanying sketch. When the wheel strikes an obstruction instead of breaking the blade the pin will shear off, thus saving the wheel. A new pin can be put in in a few minutes' time and a lot of trouble and delay avoided. The wheel is kept from being lost by a washer and cap screw in the end of the shaft as shown.—Contributed by Charles C. Brabant, Alpena, Michigan.



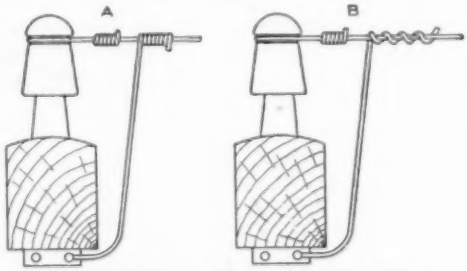
Open Circuit Caused by Wrapping Wire Too Closely

The following case of trouble proved interesting to me and may prove so to others, says a correspondent of Telephony.

The test showed that one side of the circuit was open (this trouble was in a straight metallic circuit on a magneto system). The first test was made at the office end of the cable, which showed the line O. K. to the board, so I then went out to the cable pole and tested in O. K. I then tested my bridle wires, only to find them O. K. and apparently well soldered to the line wires. Next I began to cover my line, driving about a mile and a half, where I stopped to test, and found the line open between this place and the office. I then recovered the line, testing every joint I came to. This series of tests led me back to the cable pole, where I located my trouble.

The joint which I supposed was well soldered proved to be the site of my trouble. The birdle wire was wrapped in close turns around the line wire, as shown in Fig. A in the illustration, and the solder had flown over the outside and not down to the line wire, thus leaving the soldering part to corrode the joint and cause the open joint.

Had this bridle wire been wrapped in a helix, as shown in Fig. B, such a case of trouble would never have happened, providing the wires were properly prepared and cleaned previous to soldering.



Right and Wrong Ways of Twisting Wire

Carburetor troubles are usually caused by dirt or water in the gasoline.

Collapsible Chicken Coop

The average chicken coop made of a soap box or some other small box is not always convenient for carrying around and use in different places. An A-shaped coop is little better than an ordinary box. The accompanying sketch shows a collapsible A-shaped coop that can be folded and stored away or carried and set up for use anywhere. The main frame is made in four parts and joined together with hinges as shown in Fig. 1. The frame can be covered with wire netting, or boards on the top part with netting on the ends. The hinged frames provide a way to open either end. A small

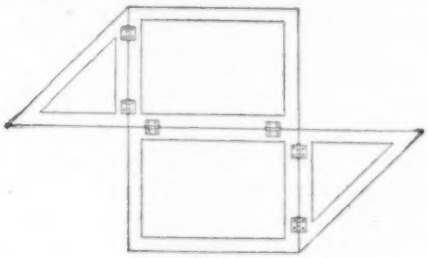


FIG. 1

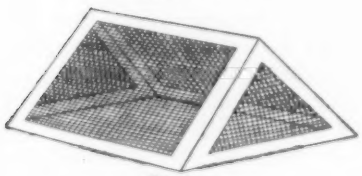


FIG. 2

Parts Are Hinged Together

hook and eye should be provided at each end to hold the parts in place.—Contributed by Miss L. Alberta Norrell, Augusta, Ga.

Home-Made Stove Poker

Many persons prefer a straight stove poker instead of a hooked one. In fact, a hooked poker is useless in some grates, but the trouble with a perfectly smooth and straight poker is that simply pushing it over or through a grate has little effect on the ashes. A poker that is straight and yet one that has something that will agitate the ashes is most desirable. To make such a poker I hit upon the idea as illustrated in the sketch. The poker is twisted from three strands of No. 8 or 9 steel wire. Drawing this poker

Twisted Wire Stove Poker

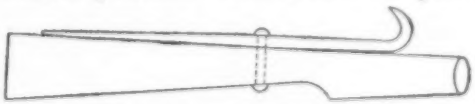
rapidly through the ash under a fire has a much more agitating effect than is possible to obtain from a smooth rod, moreover, it wears excellently.

This poker is made of two pieces of wire, one 6 ft. long, the other, 3 ft. Give the long piece one and a half turns around a suitable pipe or broom handle. Take the short piece and wrap one end of it securely around the pipe right against the other piece; then clamp the three free ends in a vise and twist the wires until the desired gauge is obtained, when the poker is cut to the right length and pointed. Finally cut off the third wire just below the handle loop and your poker is ready for use.

Four strands of smaller wire might be used in a similar manner. If ordinary straight wire is used and kept stretched in twisting, little or no straightening will be necessary when completed.—Contributed by O. E. Miller, Philadelphia, Pa.

Combined Belt Punch, Scratch Awl and Hook

The accompanying sketch shows a simple design of a common leather belt punch, scratch awl and hook, and will be found a very useful little article in repairing or lacing belts. After trying it, no one who uses belts will want to be without one, says a correspondent of the American Miller. The awl and hook is riveted to an ordinary belt punch, so that it can be turned in any desired position. The hook is for pull-

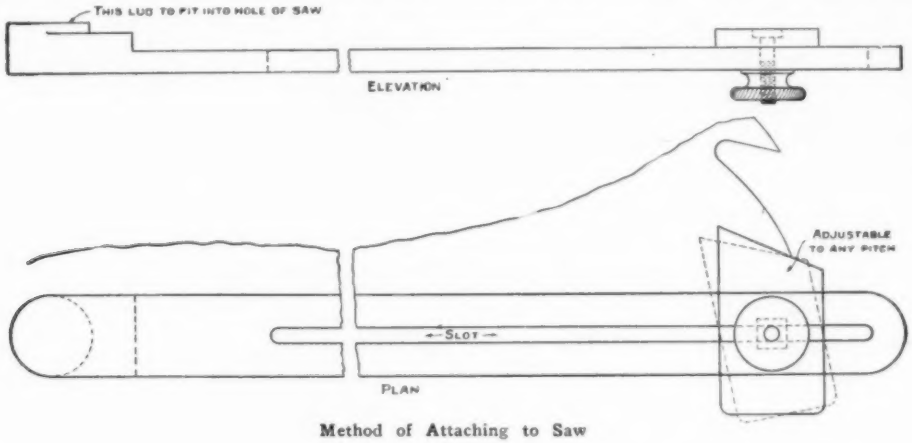


The Punch with Hook Attached

ing out the laces and the awl for enlarging the holes when lacing.

Tool to Mark the Pitch of Saw Teeth

The accompanying sketch shows a handy little tool for marking the pitch on circular saw teeth and will be of great use to those who have much saw filing to do, says a correspondent of the Wood-Worker. The total is very simple and easy to make and the size can be varied to suit the needs of the saw filer. The lug which fits into the hole of the saw may be made about 1 in. in diameter and will do for any saw with a hole 1 in. or over. The method of using the tool is: Place the lug in the hole of the saw, then fix the piece marking the bevel at the desired angle, and proceed to mark off the pitch of the teeth.



Method of Attaching to Saw

A Love Knot Cable Puller

Many times it is necessary to pull wires or ropes or cables through a pipe or conduit whose interior diameter is not large enough to allow for any way to fasten the pulling wire. A handy contrivance for overcoming this difficulty is the adaptation of the old familiar "love knots." Many of us have placed our fingers in the ends of these love knots with ease and then found to our surprise that we could not get them out quite so easily.

Love Knot Grip

To make this device take several wires, which will depend upon conditions, and double them at the middle so as to form a loop. Wrap them at this point to keep the ends in good shape and then proceed to weave them around the end of the cable or something of approximately the same diameter. The sketch shows the method. It is not necessary to weave the ends closely; in fact, it is better to leave considerable space between the separate wires, as the puller will better adapt itself to the different sized cables or ropes. After weaving far enough for each strand to encircle the cable several times, the ends may be held down by means of a string, rubber band or any other convenient means. If the loop is now pulled, it will be found that the love knot clings tightly to the cable and the harder the pull, the tighter the grip. If the knot is pushed from the end opposite the loop it may be slipped off the cable with ease. The same knot will fit cables having varying diameters. The flexible wire used ordinarily for hanging pictures will be found convenient for making medium sized pullers.—M. R. W.

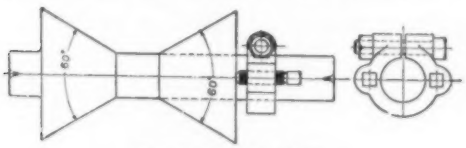
Dry batteries to be used in a cellar should be placed on a plate of glass to prevent any possible ground.

A Self-Centering Arbor

The self-centering arbor, shown in the accompanying sketch, can be made in any machine shop at a small cost, and does the work as well or better than some of the more expensive ones.

Secure a piece of steel of the proper size, for the work required, center and turn a cone on one end as shown in the sketch. Now turn a cone collar of the same size that will go on the shaft with a sliding fit. Also make a split collar and tap for two set screws as per sketch.

To use the arbor, the two loose collars are taken off the shaft and the work put on. Slide the cone collar on the shaft, small end first, then the split collar, which will clamp firmly to the shaft by means of the bolt. Now draw the set screws up tight and the piece is ready to be worked. If the tapered parts of the arbor are knurled, they will

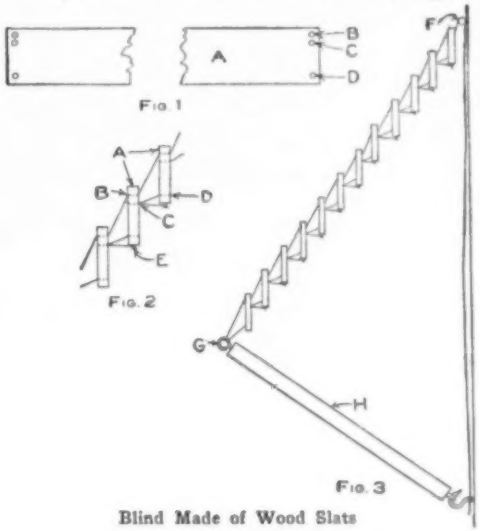


The Completed Arbor

grip the work more firmly and give a more powerful drive.—Contributed by Charles Stem, Phillipsburg, N. J.

How to Make a Slat Window Blind

The slat window blind is especially constructed to admit a circulation of air and at the same time keep out the sun's rays. A cloth shade or awning will hold the heated air in the upper part, as well as water on the top where the cloth sags. The slat blind or awning does not have these objections. The blind is constructed from 12 lath or slats. Each piece, as represented at A, Fig. 1, has three 3/16-in. holes drilled in each end, one (B) ¼ in. from the top, another (C) just below B and ½ in. from the top, and another ¼ in. from the bottom. Run a piece of string through the hole C in one piece and through hole D in the other; knot both ends so the string cannot pull out. Tie each slat together in this manner, as shown in Fig. 2. The length of this string can be varied somewhat, but it



Blind Made of Wood Slats

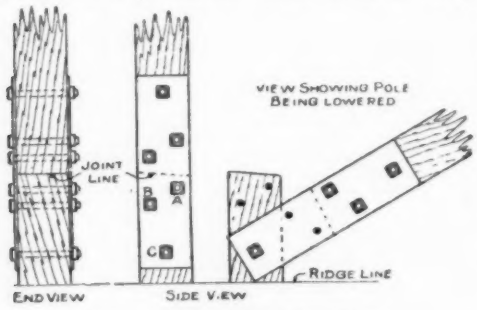
must not be too long or the slats will be far enough apart to let in streaks of sunlight. Another string is run through the hole C, knotted and tied to a nail E on the lower edge of the slat above. This is also shown in Fig. 2. Join all slats in the same manner and then run a heavy cord through the hole B in all of the slats.

Two broomsticks, H, with screweyes turned in each end, are used to keep the lower end of the blind out at a distance from the window. The heavy cord placed through the holes B and one from the hole D in the last slat are tied in a screweye on the end of the broom handle. The other screweye is placed on a hook that is turned into the window casing. The top end of the heavy cord is run over a pulley F, Fig. 3, and down the side of the window casing. A pull on this cord will draw all the slats up in a small flat bunch at the top of the window.—Contributed by Maurice Baudier, New Orleans, La.

In an emergency common pasteboard will make a good gasket for water or gas joints on an automobile. It is not good for the exhaust pipes on account of the excessive heat.

Hinge for Flag Pole

It is usually a difficult and dangerous task to rig a flag pole after it is once in permanent position. But it is a very



Joint and Method of Lowering

simple operation, if the pole is constructed with a hinge joint as shown in the accompanying sketch. The hinge consists of two steel plates bolted to the pole, one on each side. By removing the bolts A and B and gradually releasing bolt C, the pole can be lowered without much trouble. The size of the plates and bolts are governed by the height of the pole and the size of the flag. The joint should be cut at an angle so as to allow the top piece to clear the bottom piece when it is being lowered.—Contributed by Arch Owen, Youngstown, Ohio.

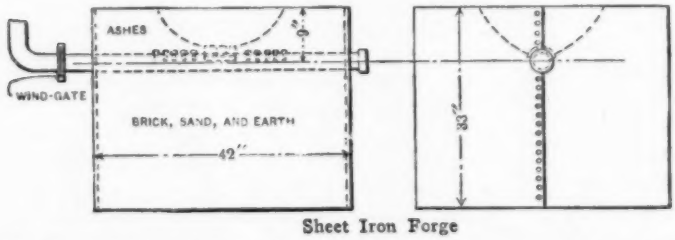
Repairing Cracked Water Jackets on Automobile Engines

Last fall the jacket water in both cylinders of my automobile froze and the expansion from the frozen water bulged and cracked the water jackets which were ⅛ in. thick, the crack being 6 in. long. A firm quoted a price of $35 to braze the broken jackets and this, combined with disconnecting, transportation charges, and replacing the cylinders, seemed too expensive for such a little break, and as no damage was done except to the water jackets I decided to try a compound consisting of equal parts of sal ammoniac, sulphur and iron filings. The filings I procured from the base of a blacksmith's anvil. The three parts were mixed together with water to a consistency of cream and allowed to stand for 30 minutes. An old broken knife was used to crowd this mixture into the cracks, then the openings at the bottom of the jackets were plugged with corks and the jackets filled with a solution of sal ammoniac and water. This solution was allowed to stand in the jackets for 24 hours, then drained and a new solution put in for another 24 hours.

This sealed the cracks completely and not a drop of water has leaked out and the car has been running for some time. The paste is so smooth that the break is not perceptible.—Contributed by Charles Hodge, East Bethany, New York.

A Home-Made Forge

A correspondent writing in Machinery describes the construction of a cheap forge, the body of which is made from ⅛-in. sheet metal formed into a cylinder with a diameter of 42 in. and 33 in. high. About 9 in. from the top edge two holes are cut opposite each other to admit a 2½ or 3-in. common steam pipe. The pipe to be used should have sufficient length to pass through the cylinder and have a 2-in. extension on one side and 6 or 8 in. on the other. The short end is fitted loosely with a cap so it may be removed and put on by hand. The long end of the pipe has a wind gate attached which is connected to the blast pipe. A 1¾-in. hole is drilled in the side of the pipe at a point where it will be in the center of the cylinder,



Sheet Iron Forge

and on each side of the hole three ¾-in. holes followed by two ⅝-in. holes about 3 in. apart, are drilled. The center large hole is protected with a piece of steel 1 in. thick, 4 or 5 in. wide and long enough to go one-third around the pipe, which is bent to fit the outside diameter of the pipe and attached with some fire clay directly over the hole in the pipe.

After the forge constructed in this manner is leveled up, broken brick, sand, dirt and cinders are dumped in and packed firmly up to the lower side of the pipe. The small holes in the pipe are filled with ½-in. bolts or rivets that are about 1½ in. long, and then the remaining part of the cylinder is filled up with cinders and packed firmly, space being left to form a pit for the fire.

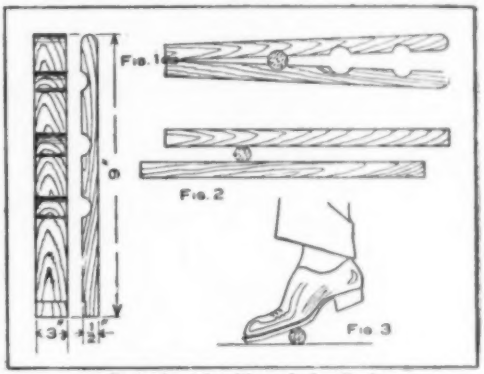
If a long fire is required in this forge, enough cinders are picked out to uncover the extra holes in the pipe, and the bolts or rivets mentioned taken out; the length of the fire can be adjusted to the requirements by taking out more or less bolts.

When the fire gets dirty, use the poker and poke the dirt down through the hole. Take off the cap at the end of the pipe and open the wind gate and blow out the cinders inside of the pipe. It takes no more than two minutes to clean a fire in one of these forges.

How to Fit Corks

Occasionally odd-sized bottles are received in stores which require corks cut to fit them. No matter how sharp a knife may be, it will leave some sharp edges after cutting the cork which will cause leakage. The illustration shows three very effective methods of reducing the size of corks. The one shown in Fig. 1 is made from two pieces of ½-in. wood fastened together at one end with a common hinge. Two or three grooves are cut crosswise in sizes desired. The cork is put into the groove and both pieces are pressed together, which will make the cork smaller.

Rolling the cork between two flat surfaces (Fig. 2) is simple and almost as good as pressing in the grooves. A

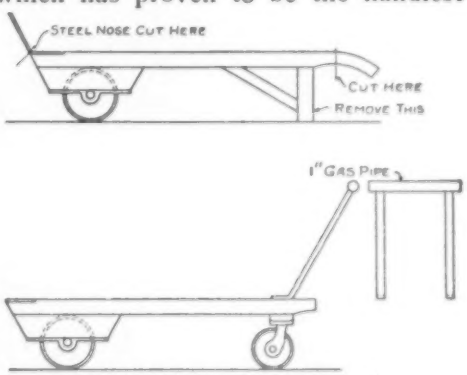


Reducing the Size of the Cork

cork rolled on the floor (Fig. 3) is a quick and effective way. A slower and equally as good way is to soak the cork in hot water for a short time.—Contributed by L. Szerlip, Brooklyn, New York.

A Handy Mill Truck

The accompanying sketch shows how a four-wheel truck was made out of a two-wheel one, says a correspondent of the American Miller. The steel nose, the wood handles and the iron legs were removed from an 800-lb. truck as shown in the sketch, and the upright handles and casters put on. The result is a four-wheel scale truck which has proven to be the handiest



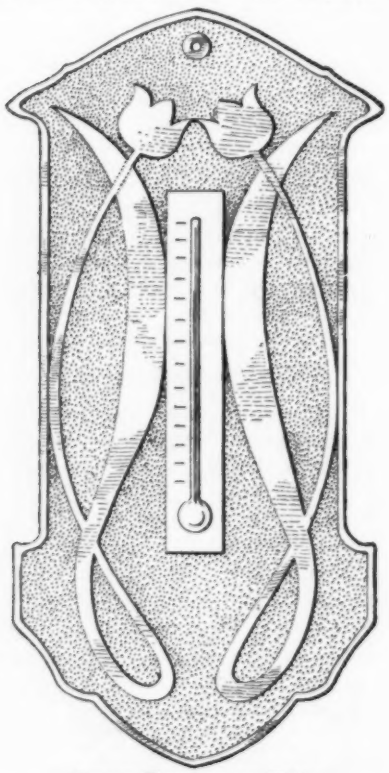
Showing Changes Made in Truck

truck in the mill. One can put on the load, weigh it and run it wherever wanted.

AMATEUR MECHANICS

How to Make a Thermometer Back in Etched Copper

Etching copper is not a very difficult process. Secure a sheet of No. 16 gauge copper of a width and length such as is wanted for the back of the thermometer. In the design shown the extreme width is 3½ in. and the extreme length 7 in.



Copper Thermometer Holder

Draw a design. The one shown is merely suggestive. The worker may change the outline or proportions as desired. The decoration, too, may be changed. The essential thing is to keep a space upon which to place the thermometer. This design is in what is known as two-part symmetry. A line is drawn down the paper and one-half of the outline and decoration worked out. This done, the paper is folded along the center-line, a piece of carbon is inserted between the folds and the design transferred on the inner surfaces by tracing with a pencil over the one-half of the outline previously drawn. Trace the design and outline upon the metal, using the carbon paper.

Cut out the outline with the metal shears and file the edges smooth.

With a small brush and ordinary asphaltum or black varnish paint the design, the margin and the entire back of the metal. When this coat has dried put on a second and then a third. The asphaltum is to keep the acid into which the metal is to be immersed later from eating the metal other than the background. Two coats or more are needed to withstand the action of the acid.

The acid bath is composed of nitric acid and water about half and half, if anything, a little less acid than water. Keep this solution off the hands and clothes and do not inhale the fumes.

Put the asphalt coated metal in the bath and allow it to remain for four or five hours, depending upon the thickness of the metal and the strength of the acid. With a stick or a pair of old tongs take the metal out of the acid occasionally and examine it to see how deep it has been eaten by the acid—1/32 in. is about right for the No. 16 gauge.

When etched to the desired depth, remove the piece and with an old knife scrape the asphaltum off. Finish the cleaning by scrubbing with turpentine and a brush having stiff bristles.

If the metal is first covered with turpentine and then heated over a flame, all the colors of the rainbow will appear on its surface. These colors fade away in the course of a long time.

but they can be easily revived. Another way to get these colors is to heat the metal and then plunge it into the acid bath quickly.

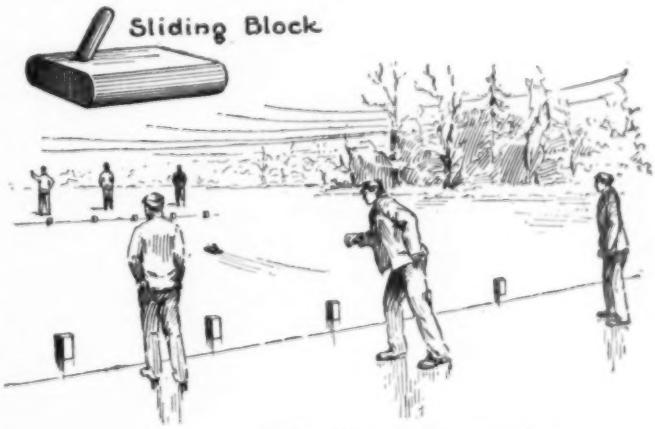
A green finish is obtained by painting the background with an acid stain composed as follows: 1 part ammonia muriate; 3 parts ammonia carbonate; 24 parts water. If one coat does not give the depth of color desired, repeat as many times as is necessary, allowing each coat time to dry before applying the next.

To "fix" this color so that it will not rub off, and to keep the metal from tarnishing, apply a coat of banana oil or lacquer.

Thermometers of suitable size can be bought in either brass or nickel. They have holes through their top and bottom ends through which metal stationery paper fasteners can be inserted and these in turn put through holes punched in the copper back.

A Game Played on the Ice

Two lines are drawn parallel on the ice from 50 to 100 ft. apart and blocks of wood are placed every 6 ft. apart on these lines. The player opening the game skates to the line and delivers in bowling form a sliding block similar to the blocks that are placed on the lines with the exception that it has a handle. The blocks are about 6 in. square and 8 in. long. The sliding blocks should be at least 1 ft. long and each one provided with a handle. The handle is attached by boring a hole near one end and in the middle of the block and a wood pin driven in. The hole is bored slanting so as to incline the handle. Two of these blocks are provided for the reason that when a player bowls one of the opposing player's blocks over the line he is entitled to another cast. The side wins that bowls over all of the opposing player's blocks first. This will prove an interesting and enjoyable pastime for skaters.—Contributed by John F. Hassler, Port London, Can.



Bowling Over the Opponent's Blocks

Making a Fire with the Aid of Ice

Take a piece of very clear ice and melt it down in the hollow of your hands so as to form a large lens. The illustration shows how this is done. With the lens-shaped ice used in the same manner as a reading glass to direct the sun's rays on paper or shavings you can start a fire.—Contributed by Arthur E. Joerin, 6 Bis Rue de Lyon, Paris, France.

Forming the Ice Lens

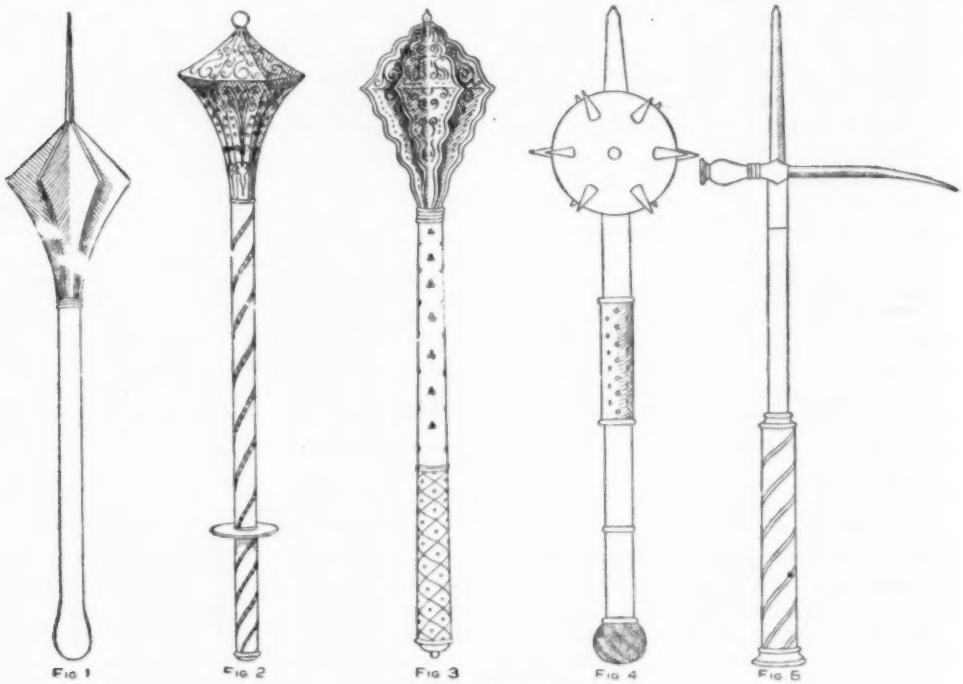
Home-Made Magnifying Glass

A very good magnifying glass can be made from an ordinary incandescent lamp of about 16 cp. size which has been rendered useless by being burned out or the filament broken. Grind or break off the tip end of the globe and fill with water. Put in as clear water as possible and plug or cork up the small hole.—Contributed by W. C. Bliss, St. Louis, Mo.

Imitation Arms and Armor

PART III

Maces and battle-axes patterned after and made in imitation of the ancient weapons which were used from the fourteenth to the sixteenth century produce fine ornaments for the hall or den, says the English Mechanic. The imitation articles are made of wood, the steel parts represented by tinfoil stuck on with glue and the ornaments carved out with a carving tool.



Ancient Weapons

An English mace used about the middle of the fifteenth century is shown in Fig. 1. The entire length of this weapon is about 24 in.; the handle is round with a four-sided sharp spike extending out from the points of six triangular shaped wings. Cut the handle and spike from one piece of wood and glue the wings on at equal distances apart around the base of the spike. The two bands or wings can be made by gluing two pieces of rope around the handle and fastening it with tacks. These rings can be carved out, but they are somewhat difficult to make. After the glue is dry, remove all the surplus that has been pressed out from the joints with the point of a sharp knife blade and then sandpaper the surface of the wood to make it smooth. Secure some tinfoil to cover the parts in imitation of steel. A thin coat of glue is quickly applied to the surface of the wood and the tinfoil laid on evenly so there will be no wrinkles and without making any more seams than is necessary. The entire weapon, handle and all, is to appear as steel.

An engraved iron mace of the fifteenth century is shown in Fig. 2. This weapon is about 22 in. long, mounted with an eight-sided or octagonal head. It will be easier to make this mace in three pieces, the octagonal head in one piece and the handle in two parts, so that the circular shield shown at the lower end of the handle can be easily placed between the parts. The circu-

lar piece or shield can be cut from a piece of wood about ¼ in. thick. The circle is marked out with a compass. A hole is made through the center for the dowel of the two handle parts when they are put together. A wood peg about 2 in. long serves as the dowel. A hole is bored in the end of both handle pieces and these holes well coated with glue, the wood peg inserted in one of them, the shield put on in place and handle parts put together and left for the glue to set. The head is fastened on the end of the handle with a dowel in the same manner as putting the handle parts together.

The head must have a pattern sketched upon each side in pencil marks, such as ornamental scrolls, leaves, flowers, etc. These ornaments must be carved out to a depth of about ¼ in. with a sharp carving tool. If such a tool is not at hand, or the amateur cannot use it well, an excellent substitute will be found in using a sharp-pointed and red-hot poker, or pieces of heavy wire heated to burn out the pattern to the desired depth. The handle also has a scroll to be engraved. When the whole is finished and cleaned up, it is covered with tinfoil in imitation of steel. The tinfoil should be applied carefully, as before mentioned, and firmly pressed into the engraved parts with the finger tips or thumb.

A French mace used in the sixteenth century is shown in Fig. 3. This weapon is about 22 in. long and has a wood handle covered with dark red cloth or velvet, the lower part to have a gold or red silk cord wound around it, as shown, the whole handle finished off with small brass-headed nails. The top has six ornamental carved wings which are cut out, fastened on the handle and covered with tinfoil, as described in Fig. 2.

Figure 4 shows a Morning Star which is about 26 in. long. The spiked ball and the four-sided and sharp-pointed spike are of steel. The ball may be made of clay or wood and covered with tinfoil. The spikes are cut out of wood, sharp-pointed and cone-shaped, the base having a brad to stick into the ball. The wood spikes are also covered with tinfoil. The handle is of steel imitation, covered in the middle with red cloth or velvet and studded with large-headed steel nails.

A war hammer of the fifteenth century is shown in Fig. 5. Its length is about 3 ft. The lower half of the handle is wood, covered with red velvet, with a golden or yellow cord wound spirally over the cloth. The upper half of the handle is steel, also,

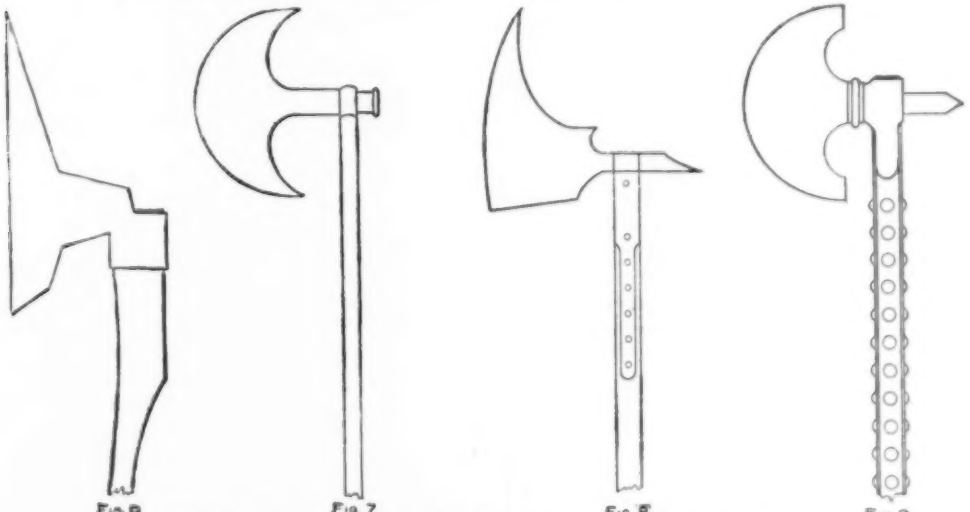


FIG. 6 FIG. 7 FIG. 8 FIG. 9

Battle Axes of the Fourteenth, Fifteenth and Sixteenth Centuries

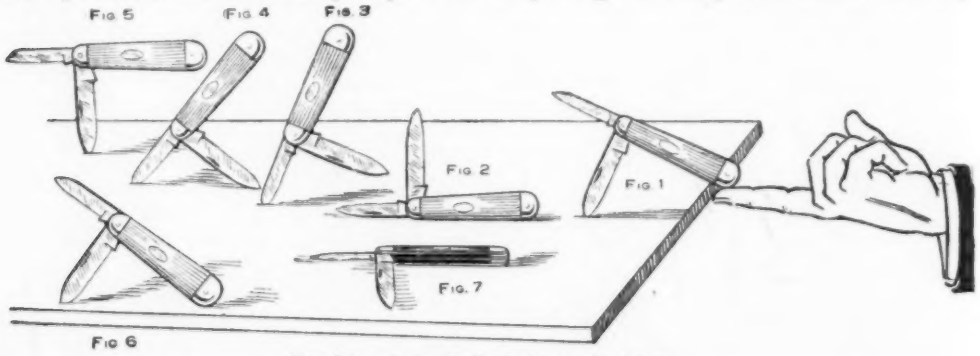
the hammer and spike. The entire handle should be made of one piece, then the hammer put on the base of the spike. The spike made with a peg in its lower end and well glued, can be firmly placed in position by the peg fitting in a hole made for its reception in the top of the handle. Finish up the steel parts with tinfoil.

The following described weapons can be constructed of the same materials and built up in the same way as described in the foregoing articles: A horseman's short-handled battle-axe, used at the end of the fifteenth century, is shown in Fig. 6. The handle is of wood and the axe in imitation steel. Figure 7 shows an English horseman's battle-axe used at the beginning of the reign of Queen Elizabeth. The handle and axe both are to be shown in steel. A German foot soldier's poleaxe used at the end of the fourteenth century is shown in Fig. 8. The handle is made of dark wood and the axe covered with tinfoil. Figure 9 shows an English foot soldier's jedburgh axe of the sixteenth century. The handle is of wood, studded with large brass or steel nails. The axe is shown in steel. All of these axes are about the same length.

Playing Baseball with a Pocket Knife

An interesting game of baseball can be played by two persons with a common pocket knife on a rainy day or in the winter time when the regular game cannot be played outdoors. The knife is opened and loosely stuck into a board, as in Fig. 1, and with a quick upward movement of the forefinger it is thrown into the air to fall and land in one of the positions shown. The plays are determined by the position of the knife after the fall.

A foul ball is indicated by Fig. 2, the knife resting on its back. The small blade sticking in the board which holds the handle in an upright position, as shown in Fig. 3, calls for a home run. Both blades sticking in the board (Fig. 4), a three-base hit. A two-base hit is made when the large blade sticks in the board, Fig. 5. A one-base hit is secured when the large blade and the end of the handle touch the board as in Fig. 6. The knife falling on its side (Fig. 7) calls for one out. Each person plays until three outs have been made, then the other plays, and so on for nine innings.—Contributed by Herbert Hahn, Chicago.



Positions of the Knife Indicate the Plays

How to Remove Paper Stuck to a Negative

When making photographic prints from a negative, sometimes a drop of moisture will cause the print to stick to the gelatine film on the glass. Remove as much of the paper as can be readily torn off and soak the negative in a fresh hypo bath of 3 or 4 oz. hypo to 1 pt. of water for an hour or two. Then a little gentle rubbing with the finger—not the finger nail—will remove anything adhering to the film. It may be found that the negative is not colored. If it is spotted at all, the negative must be washed for a few minutes and placed in a combined toning and

fixing bath, which will remove the spots in a couple of hours. The negative must be well washed after going through the solutions to take away any trace of hypo.

Old-Time Magic—Part X

A Sack Trick

The magician appears accompanied by his assistant. He has a sack similar to a meal bag only on a large scale. The upper end of this bag is shown in Fig. 1, with the rope laced in the cloth. He then selects several people from the audience as a committee to examine the sack to see that there is absolutely no deception whatever in its makeup. When they are satisfied that the bag or sack is all right, the magician places his assistant inside and drawing the bag around him he allows the committee to tie him up with as many knots as they choose to make, as shown in Fig. 2.

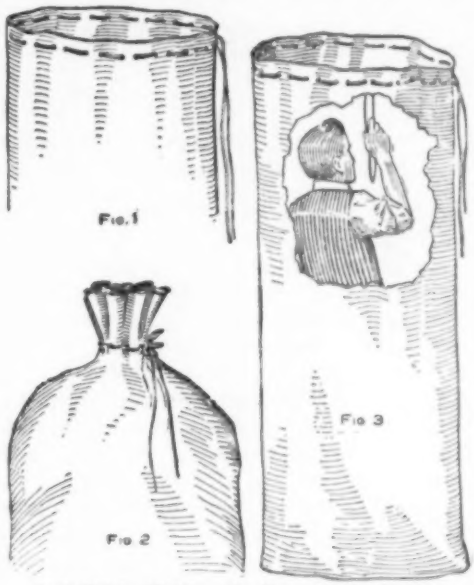
The bag with its occupant is placed in a small cabinet which the committee surround to see that there is no outside help. The magician then takes his watch and shows the audience that in less than 30 seconds his assistant will emerge from the cabinet with the sack in his hand. This he does, the sack is again examined and found to be the same as when it was first seen.

The solution is when the assistant enters the bag he pulls in about 15 in. of the rope and holds it, as shown in Fig. 3, while the committee is tying him up. As soon as he is in the cabinet he merely lets out the slack thus making enough room for his body to pass through. When he is out of the bag he quickly unties the knots and then steps from his cabinet.—Contributed by J. F. Campbell, Somerville, Mass.

The Invisible Light

The magician places two common wax candles on a table, one of them burning brightly, the other without a light. Members of the audience are allowed to inspect both the table and the candles.

The magician walks over to the burning candle, shades the light for a few seconds, turns to the audience with his hands a few inches apart, showing that there is nothing between them, at the same time saying that he has a light between his hands, invisible to them (the audience), with which he is going to light the other candle. He then walks over to the other candle, and, in plain sight of the audience lights the candle apparently with nothing.



Sack Trick—Holding the Rope Inside the Bag

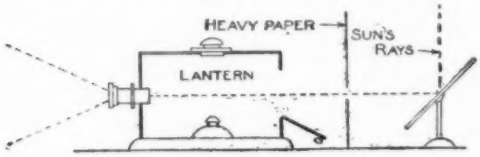
In reality the magician has a very fine wire in his hand which he is heating while he bends over the lighted candle, and the audience gaze on and see nothing. He turns to the other candle and touches a grain of phosphorus that has been previously concealed in the wick with the heated wire, thus causing it to light.—Contributed by C. Brown, New York City.

Using the Sun's Light in a Magic Lantern

The light furnished with a small magic lantern does very well for evening exhibitions, but the lantern can be used in the daytime with good results by directing sunlight through the lens instead of using the oil lamp.

A window facing the sun is selected

and the shade is drawn almost down, the remaining space being covered by a piece of heavy paper. A small hole is



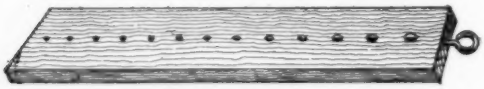
Sun's Rays Pass Through Lantern

cut in the paper and the lantern placed on a table in front of the hole, the lamp having been removed and the back opened. The lantern must be arranged so that the lens will be on a horizontal line with the hole in the paper. A mirror is then placed just outside of the window and at such an angle that the beam of light is thrown through the hole in the paper and the lens of the lantern.

The shades of the remaining windows are then drawn and the lantern is operated in the usual way.—Contributed by L. B. Evans, Lebanon, Ky.

A Handy Drill Gauge

The accompanying sketch shows a simple drill gauge which will be found very handy for amateurs. The gauge consists of a piece of hard wood, ¾ in. thick, with a width and length that will be suitable for the size and number of drills you have on hand. Drill a hole through the wood with each drill you have and place a screweye in one end to be used as a hanger. When you want to drill a hole for a pipe, bolt,



Drill Gauge

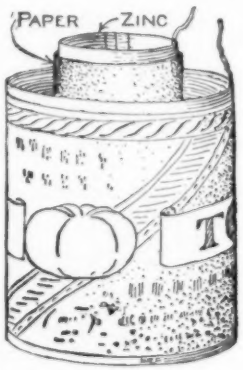
screw, etc., you take the gauge and find what size drill must be used in drilling the hole.—Contributed by Andrew G. Thome, Louisville, Ky.

A good stove polish can be made by mixing together 1 lb. of plumbago, 4 oz. of turpentine, 4 oz. of water and 1 oz. of sugar. Mix well and apply with a cloth or brush.

A Home-Made Daniell Cell

An effective Daniell galvanic cell may be constructed from material costing very little money. A common tin tomato can with a copper wire soldered to the top forms the jar and positive electrode. A piece of discarded stove zinc rolled into an open cylinder of about 1½-in. diameter, 5 in. long, with a copper wire soldered at one end forms the negative electrode.

To make the porous cell, roll a piece of heavy brown wrapping paper, or blotting paper, into a tube of several thicknesses, about 5 in. long with an internal diameter of 2 in. Tie the paper firmly to prevent unrolling and close up one end with plaster of paris ½ in. thick. It is well to slightly choke the tube to better retain the plaster. The paper used must be unsized so that the solutions can mingle through the pores.



Two liquids are necessary for the cell. Make a strong solution in a glass or wooden vessel of blue vitriol in water. Dilute some oil of vitriol (sulphuric acid) with about 12 times its measure of water and keep in a bottle when not in use. In making up the solution, add the acid to the water with constant stirring. *Do not add water to the acid.*

The cell is charged by placing the zinc in the paper tube and both placed into the tin can. Connect the two wires and pour the dilute acid into the porous cell around the zinc, and then immediately turn the blue vitriol solution into the can outside the paper cup.

A current generates at once and metallic copper begins to deposit on the inside of the can. It is best to let the action continue for a half hour or so before putting the cell into use.

Several hours working will be required before the film of copper becomes sufficiently thick to protect the tin from corrosion when the cell stands idle. For this reason it will be necessary to pour out the blue vitriol solution into another receptacle immediately after through using, as otherwise the tin would be soon eaten full of holes. The porous cup should always be emptied after using to prevent the diffusion of the blue vitriol solution into the cup, and the paper tube must be well rinsed before putting away to dry.

This makes one of the most satisfactory battery cells on account of the constancy of its current, running for hours at a time without materially losing strength, and the low cost of maintenance makes it especially adapted for amateurs' use. Its current strength is about one volt, but can be made up into any required voltage in series. A battery of a dozen cells should cost not to exceed 50 cts. for the material, which will give a strong, steady current, amply sufficient for all ordinary experimental work.

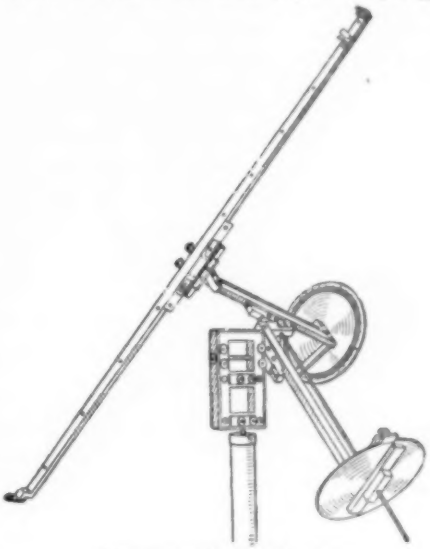
A strong solution of common salt may be used in place of the oil of vitriol in the porous cup, but is not so good.—Contributed by C. H. Denniston, Pulteney, N. Y.

A Home-Made Equatorial

By Harry Clark

The ordinary equatorial is designed and built for the latitude of the observatory where it is to be used. This is necessary since the hour axis must point to the north pole of the heavens whose elevation above the horizon is equal to the latitude of the observer's station. The final adjustment of an ordinary equatorial is very tedious so that when once set up it is not to be moved. This calls for a suitable house to protect the instrument. It has been the aim of the writer to build a very simple instrument for amateur work which would be adjustable to any latitude, so easily set up ready for work and so portable that it need not be left out of doors from one evening until the next.

The instrument is mounted on a tripod or piece of iron pipe carrying a



Instrument for Locating Stars

short vertical rod of ⅜-in. steel. A rectangular wooden frame with suitable bearings rotates about this shaft. The frame has also two horizontal bearings carrying a short shaft to the end of which the frame carrying the hour axis is firmly clamped. By this arrangement of two perpendicular shafts the hour axis may be directed to any point in the heavens without care as to how the tripod or pipe is set up.

The frame for the hour axis is about 12 in. long with a bearing at each end. The shaft which it carries is ¼-in. steel, carrying the hour circle at one end, and at the other the frame for the declination axis which is similar to the other, but somewhat lighter. The declination axis is also of ¼-in. steel, carrying at one end the declination circle and the pointer at the other.

The entire frame of the instrument is made of cherry and it will save the builder much time if he will purchase cherry "furniture" which is used by printers and can be obtained from any printers' supply company. It is best quality wood free from imperfections in straight strips one yard long and of a

uniform width of about ⅝ in. As to thickness, any multiple of 12-point (about ⅛ in.) may be obtained, thus saving much work in fitting up joints. Fifty cents will buy enough wood for an entire instrument. All corners are carefully mortised and braced with small brass angle-pieces. The frame is held together by small brass machine screws. After much experimentation with bearings, it was found best to make them in halves as metal bearings are usually made. The loose half is held in place by guides on all four sides and is tightened by two screws with milled nuts. A great deal of trouble was experienced in boring out the bearings until the following method was devised. One hole was bored as well as possible. The bearing was then loosened and a bit run through it to bore the other. Finally, a piece of shafting was roughened by rolling it on a file; placed in both bearings and turned with a brace. The bearings were gradually tightened until perfectly ground.

The declination axis must be perpendicular to both the hour axis and the line of sight over the pointer. To insure this, a positive adjustment was provided. The end of the shaft is clamped in a short block of wood by means of a bearing like the ones described. One end of the block is hinged to the axis frame, while the other end is attached by two screws, one drawing them together, the other holding them apart. The axis is adjusted by turning these screws. Each shaft, save the one in the pipe, is provided with this adjustment.

The pointer is of two very thin strips placed at right angles and tapered slightly at each end. The clamp is attached as shown in the illustration. The eye piece is a black iron washer supported on a small strip of wood. The aperture should be ¼ in., since the pupil of the eye dilates very much in darkness. The error due to large aperture is reduced by using a very long pointer which also makes it possible to focus the eye upon the front sight and the star simultaneously. The forward sight is a bright brass peg illuminated by a tiny electric lamp with a reflector to shield the eye. The pointer arranged in this way is a great improvement over the hollow tube sometimes used, since it allows an unobstructed view of the heavens while indicating the exact point in question.

The circles of the instrument are of aluminum, attached to the shafts by means of wooden clamps. They were nicely graduated by a home-made dividing engine of very simple construction, and the figures were engraved with a pantograph. The reading is indicated by a cut on a small aluminum plate attached to a pointer. The hour circle is divided into 24 parts and subdivided to every four minutes. The figures are arranged so that when the instrument is set up, the number of hours increases while the pointer travels oppositely to the stars. The declination circle is graduated from zero to 90 deg. in each direction from two points 180 deg. apart. It is adjusted to read zero when the pointer and two axes are mutually perpendicular as shown in the picture.

To adjust the instrument it is set up on the iron pipe and the pointer directed to some distant object. All set screws, excepting those on the declination axis, are tightened. Then the pointer is carefully turned through 180 deg. and if it is not again directed to the same point, it is not perpendicular to the declination axis. When properly set it will describe a great circle. With the declination axis in an approximately horizontal position the place where the pointer cuts the horizon is noted. The declination axis is then turned through 180 deg., when the pointer should again cut at the same place. Proper adjustment will cause it to do so. It is desirable that the hour circle should read approximately zero when the declination axis is horizontal, but this is not necessary for a reason soon to be explained. All these adjustments, once carefully made, need not be changed.

In using the instrument the hour axis can be directed to the north pole

by the following method. Point it approximately to the north star. The pole is 1 deg. and 15 min. from the star on a straight line from the star to "Mizar," the star at the bend of the handle in the Big Dipper. Turn the hour circle into a position where the pointer can describe a circle through "Mizar." Only a rough setting is necessary. Now turn the pointer so that a reading of 88 deg. 45 min. shows on the declination circle on that side of 90 which is toward "Mizar." When this is done, clamp both axes and turn the shafts in the base until the pointer is directed accurately to the north star. It is evident from a study of the picture that the position of the small pointer which indicates the reading on the hour circle is not independent of the way in which the tripod or pipe is set up. It would then be useless to adjust it carefully to zero when the pointer cuts the "zenith" as is done with a large equatorial. Instead, the adjustment is made by setting the clock or watch which is part of the outfit. The pointer is directed to Alpha, Cassiopiæ, and the hour reading subtracted from 24 hours (the approximate right ascension of the star) gives the time which the clock should be set to indicate. All of these settings should require not more than five minutes.

To find a star in the heavens, look up its declination and right ascension in an atlas. Set the declination circle to its reading. Subtract the clock time from the right ascension (plus 24 if necessary) and set the hour circle to the result. The star will then be seen on the tip of the pointer.

To locate a known star on the map, turn the pointer to the star. Declination is read directly. Add the clock time to the hour reading to get right ascension. If the result is more than 24 hours, subtract 24.

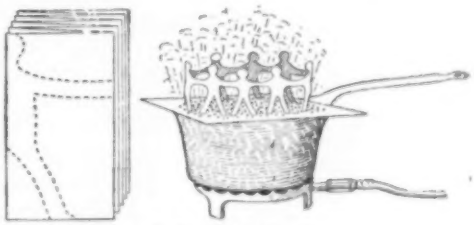
A Ground Glass Substitute

Ordinary plain glass coated with the following mixture will make a good ground glass substitute: Dissolve 18 gr. of gum sandarac and 4 gr. of gum mastic in 3½ dr. of ether, then add 1 2-3 dr. benzole. If this will be too transparent, add a little more benzole, taking care not to add too much. Cover one side of a clear glass and after drying it will produce a perfect surface for use as a ground glass in cameras.—Contributed by Ray E. Strosnider, Plain City, Ohio.

A Miniature War Dance

A piece of paper, 3 or 4 in. long, is folded several times, as shown in the sketch, and the first fold marked out to represent one-half of an Indian. Cut out all the folds at one time on the dotted line and you will have as many men joined together as there were folds in the paper. Join the hands of the two end men with a little paste so as to form a circle of Indians holding hands.

The next thing to do is to punch holes in heavy cardboard that is large enough to cover a pot or stew pan, and



Indian War Dance

partially fill the vessel with water. Set this covered vessel over a heat and bring the water to a boiling point and then set the miniature Indians on the perforated cover. The dance will begin.

If the Indians are decked out with small feathers to represent the head gear and trailing plumes, a great effect will be produced.—Contributed by Maurice Baudier, New Orleans, La.

Turning the water on before starting the gas engine may prevent breaking a cylinder on a cold day.

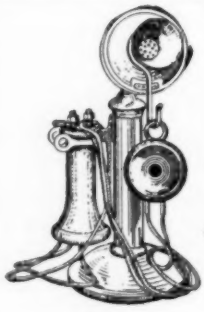


Fig. 1

Fig. 2

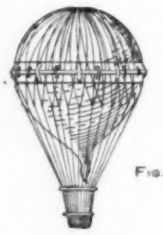


Fig. 3

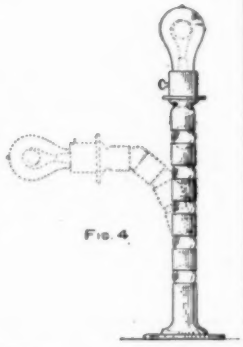


Fig. 4

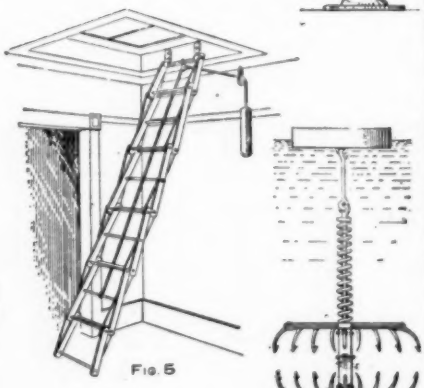


Fig. 5

Fig. 6

Fig. 7

Fig. 8

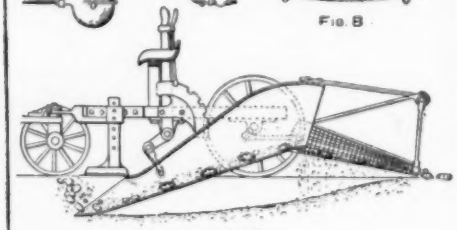


Fig. 9

RECENT

EXTRA RECEIVER FOR TELEPHONES.—The extra attachment shown on the telephone apparatus in Fig. 1 is designed to facilitate hearing. It is an extra receiver placed to the ear on the opposite side of the head from the regular receiver, and is claimed to magnify the hearing 100 per cent. Connection is made by flexible cord and a U-shaped metal end with the screws on the back of the regular receiver. For telephones in offices near railroads, in noisy sections of the city, or in a room with many typewriters, the extra attachment gives very satisfactory results.

PEN AND PENCIL HOLDER.—When persons write for long periods with pen or pencil the pressure required to hold these little implements tires and strains the fingers. The wire holder shown in Fig. 2, and designed to prevent this strain, is bent in such manner as to receive the body of the pencil or pen-holder and to fit over the forefinger and thumb.

RIGID-RING SUPPORT FOR BALLOONS.—Figure 3 illustrates a rigid-ring attachment for balloons. The ring is of metal, and is hollow, and its purpose is to provide a parachute for the aeronauts should the gas bag burst. If the upper part of the bag should burst, the pressure of the air on the under part, caused by the descent, would force that part of the bag upward into the form of a parachute, with the band as the outer edge. If the lower part should burst, the upper part would form a parachute.

ADJUSTABLE LAMP-BRACKET.—An electric-lamp standard that can be bent to any position, forward, back, or sideways, is shown in Fig. 4. It consists of a series of thimbles and balls extending from the bottom to the top.

COLLAPSIBLE ATTIC LADDER.—The collapsible attic ladder illustrated in Fig. 5 is in reality two ladders, the rungs of each being just twice the distance apart of an ordinary ladder, but so arranged that when drawn into position the two constitute a ladder with rungs of the conventional distance. The sides of the ladders consist of duplicate lazy tongs. The illustration shows the ladder extended. When collapsed, the rungs arrange themselves in three orderly groups near the ceiling, the weight sufficing to draw them up out of the way.

FISH-TRAP.—Figure 6 is a trap for catching one or a number of fish at a time. It consists of two rings, provided with a series of impaling hooks, arranged on a central supporting rod. Wound around the upper part of the supporting rod is a spring which forces the upper ring of hooks down upon the lower one when the trigger, arranged on the supporting rod between the two rings, is released. To this trigger is attached the bait.

PIPING SYSTEM FOR CUSPIDORS.—Cuspidors are considered a necessary evil in many places, especially railroad stations, hotel smoking rooms, and public gathering places. The task of keeping them sanitary, however, is one that does not appeal to the majority of workers, and is difficult to do properly, therefore, the system illustrated in Fig. 7 has been devised. Like all sinks of the usual type it is provided with flush and drain pipes, the latter being always open. When the cuspidor is used, the user presses his foot upon a spring valve in the floor beside it, and the inrush of water flushes away the deposit.

SEAMLESS SINK STRAINER.—The seamless sink strainer shown in Fig. 8 is said to be the first strictly seamless strainer on the market. It is designed to rest firmly in the corner of the sink upon three substantial legs, and is finished in all-white and speckled grey enamels to match the sink patterns most commonly used. Its seamless surface makes cleaning very simple.

POTATO-HARVESTING MACHINE.—Figure 9 is a potato digger provided with a tubular scoop which cuts under the row of potatoes as the machine progresses, and elevates soil and potatoes alike. At the back of the scoop is a screen over which the potatoes pass into bags or other receptacles while the soil falls through to the ground.

SELF-WAITING DINING TABLE.—A curiosity in recent patents is this dining-table (Fig. 10) designed to do away with the service of a maid during

PATENTS

meals, or the necessity of the housewife rising from the table to bring on the different courses. It is a table having three tops, one upon the other, and each smaller than the lower one. On these are placed the different dishes comprising the complete meal. The two upper tops revolve.

COMBINATION CHAIR AND IRONING-BOARD.—The kitchen is often too small to permit of the presence of both an ironing stand and commodious rocking chair, but by the arrangement shown in Fig. 11 both are possible in the space usually occupied by one. It is a combination rocking chair and ironing board, the back of the chair forming the top of the ironing stand, when placed in the position shown, and the top of the ironing stand forming the back of the rocking chair when set upright upon its rockers.

HANGING TABLE FOR SHIPS.—The table shown in Fig. 12, and designed for use on shipboard, hangs by a central support from a socket in a deck beam. When properly installed it will hang straight downward regardless of the ordinary roll or pitch of the ship in a storm.

PRINTING ATTACHMENT FOR PAPER-ROLL HOLDERS.—The case on the top of the paper holder in Fig. 13 contains a printing roll and an inking roll, and an impression roll is mounted in the bracket. No matter how long or how short a piece of paper the merchant wishes for wrapping purposes he can print upon it his name, place of business, and a sentence or two of advertising, in a moment's time.

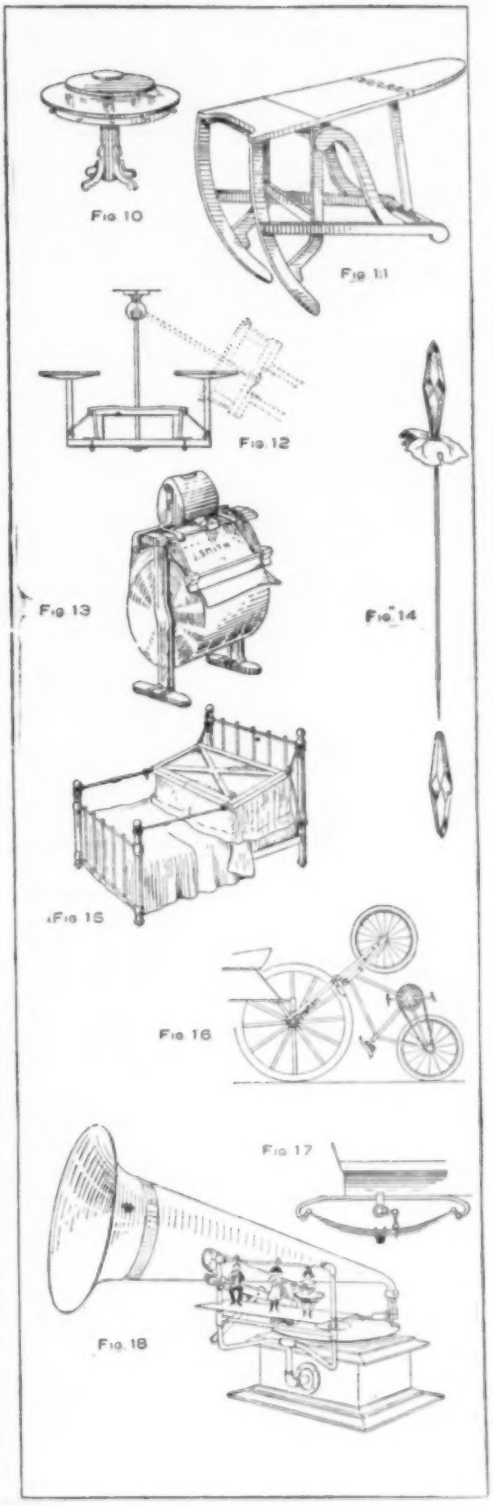
SAFETY END FOR HAT PINS.—The problem of a means of doing away with the danger of being stabbed by the points of long hat pins is solved by one inventor in the manner shown by Fig. 14. An extra head of the same shape, and apparently, if not really, of the same material as the regular head of the pin is jabbed onto its pointed end after it has been run through the hat and hair. The interior of this guard-head is of cork. With pearl-headed hat pins, the cork guard is coated with a substance resembling pearl.

BED-CANOPY.—Instead of covering the entire bed with a canopy netting to bar insects from reaching the occupants, this canopy (Fig. 15) is designed to extend over the head of the bed, providing protection for the head, shoulders, and arms and hands, which are the only parts of the sleepers not covered by the bed clothing. The framework of the canopy is suspended in position by means of elastic connection with the head and foot of the bed, and the bottom edges of the canopy sides are weighted so that they will fit closely to the irregular surfaces of the bed and its occupants, thereby preventing the entrance of insects at these points.

ATTACHMENT FOR LEADING BICYCLES.—The attachment shown in Fig. 16 makes possible the leading of a bicycle behind a buggy. It consists of a pair of bars extending along either side of the bicycle forks, both ends of the bars being adapted to be detachably connected to the bicycle-wheel axle and the rear axle of the buggy. The handle-bars of the bicycle are suspended just above the rim of the buggy wheel, and the bicycle runs on its rear wheel with the frame turned almost completely over.

PREVENTING REBOUND OF VEHICLE SPRINGS.—The rebound of the body of a vehicle after running over a rut or bump in the road is partially overcome by the spring arrangement illustrated in Fig. 17. This is accomplished by the combination of a fixed friction member, and a movable one, a cylinder having a row of notches around its circumference, and a bolt passing through the three. The notches on the cylinder do not prevent the descent of the vehicle body on the springs, but are engaged as it attempts to rebound, thus making the rise gradual instead of sharp.

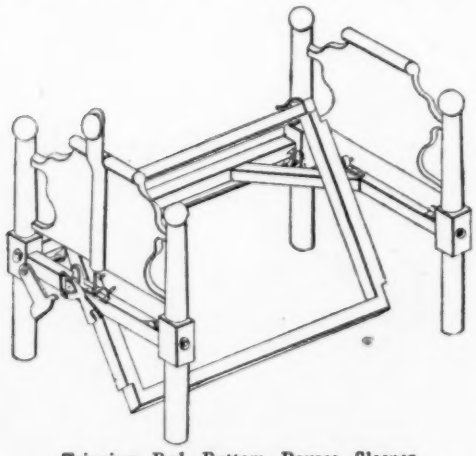
DANCING FIGURES FOR PHONOGRAPHS.—The toy shown in Fig. 18 is designed for the amusement of the young while instrumental selections are being reproduced on a phonograph. It consists of three toy figures that are made to dance on a platform while the music is being played. The figures are actuated by a pulley connection with the revolving table of the phonograph.



PATENT OFFICE RELICS

ANTI-SNORING NIGHT CAP.—Probably nothing is more exasperating to the wakeful individual than the steady, rythmical and athletic snore of a phlegmatic neighbor. To try to sleep and to fail is bad enough, but to have failure flaunted and the success of another celebrated by a solo on a wind instrument, playing always the same tune and run by perpetual motion, this stirs up evil passions and begets temptations for revenge. An inventor from New Orleans, one F. Pinckard, had evidently been the victim of such suffering. Recognizing the fact that the snorer always sleeps with the mouth open and breathes through his mouth, this inventor provided a night-cap or head-stall that held the mouth shut, as shown in the illustration. By holding the mouth shut air was cut off from the music tubes and thus the doctrine of prevention scored another triumph. This invention was covered by U. S. patent No. 84,965 granted Dec. 15, 1868 and has long been public property. A slight addition to it in the form of a padlock would no doubt make it a useful article for the suppression of scolds and hot-air artists.

THE SLUGGARD'S BEDSTEAD—"Early to bed and early to rise makes a man healthy, wealthy and wise." This old wise saw, attributed to Benjamin Franklin, no doubt expresses a deal of sound philosophy, but the difficulty with most people is in the early rising. J. C House of New York State proposed to solve the problem in an absolutely certain and effective way, and on July 17, 1855, took U. S. pat. No. 13,263 for his invention. As seen in the illustration, he formed a bedstead, with head-board, foot-board and one side rigidly connected. The bed bottom was hinged on trunnions a little to one side of the middle longitudinal line, and was provided with locking means for holding it in horizontal position during the alloted hours of sleep but when it was time to get up, the locking



Tripping Bed Bottom Rouses Sleeper

device on the bed bottom was tripped by the action of an alarm clock, and the bed bottom, yielding on its hinges, dropped down and threw the sleepy-head on the floor. The alarm clock was set to sound an alarm ten minutes before tripping the bed bottom, so that if the occupant responded to the alarm, he escaped the tumble.

HANDKERCHIEF REQUIRES 2-MONTHS' LABOR

The most remarkable and interesting of the household industries of Paraguay is that of hand lace-making. Paraguay women are famous for their skill with the needle, and this, combined with a sense of beauty and wonderful imitative faculty, makes it possible for them to produce a large variety of lace designs.

The making of a fine handkerchief requires two months' labor, working daily from sunrise to sunset, and sells for only $6. The lace bolero requires from four to six months' labor. A fine parasol cover cannot be completed within a year, and all it will bring is about $30.

The little town of Itagua, about 20 miles from Asuncion, is the center of the industry, and the grandmothers of 90 work alongside their grand daughters' daughters of 8 and 9 years in the long pillared corridors of the old houses. Probably 1,000 women and children in this district are employed exclusively in lace making.

COST OF STEAM YACHTS

A modern steam yacht of 1,000 tons, or 300 ft. over all length, would cost not less than $1,000 a foot, or $300,000 to build, and about $50,000 more for every six months kept in commission. To put such a vessel in commission, to live on board continuously or at intervals during the period of commission, and to entertain friends on board, would cost from $8,000 a month up.

The captain receives on an average $175 a month, the chief engineer $160, the chief steward $100, and the chief officer about $100. The second engineer receives $100, the second mate, if one is carried, and the steward, $60. The crew of 20 men before the mast such a vessel would require would receive $40 a month. All the officers and crew, of course, are boarded by the owner and it costs him on an average 75 cents a day a head to feed them. For a cruise of, say, six weeks, it would cost $2,000 to properly provision a yacht of the size of George Gould's "Atalanta." Coal is also an item of great expense, costing the owner about $10,000 for six months.

DO SNAKES CRAWL THROUGH THE AIR?

Once each year we indulge in what seems to merit the honor of the "Champion Snake Story," of the season and the following from the Towanda, Pa., Review has been selected:

Two Wysox men had a thrilling experience on Table Rock Mountain Monday afternoon, one which they will not care to repeat.

As they were walking on the mountain they came upon a large copperhead snake which was enjoying a sun bath about 100 yd. from the rock which gives the mountain its name. The men looked around for stones, but none that they could handle to good effect could be found, nor was there a good club at hand.

Taking sticks of good length they attacked the snake, which showed fight and struck at both men. Failing to land and not liking the lashing of the sticks his snakeship started for the edge of the mountain overlooking the river which flows at the base some 1,400 ft. below.

Reaching the edge of the table rock which hangs out from the mountainside a considerable distance, the snake arranged itself in a peculiar shape, and then with a hiss half jumped, half squirmed out into the air. The men rushed upon the shelving rock and peered over and watched the fearful descent of the snake, expecting to see it strike the trees or protruding rocks down the mountainside, but it missed all these obstructions. It was not thought possible the snake would clear the Lehigh tracks, but as the distance was covered the snake seemed to straighten out, and, as the men vow, crawled through the air and succeeded in landing in deep water with hardly a splash.

While they were watching to see if the snake came to the surface one of the men became dizzy from peering over the edge of the rock and would have followed the snake's awful example had not his companion caught him just in time.

Some idea of the distance traveled by the copperhead can be had when it is known that but few boys or men can throw a stone so that it will strike in the river as the snake did.

IMMENSE PILE OF OYSTER SHELLS

The oyster shell is of considerable value as well as the oyster it contains, and in the months without an "r," when oyster dredging is at a standstill, the great piles of shells which have been accumulated are taken away in shiploads to be dumped on the oyster beds. The oyster "spat," which, upon hatching, floats in the water a few days, sinks and attaches itself to these shells. The illustration shows a pile of shells drying in Providence, R. I. They must be dried to free them from slime.

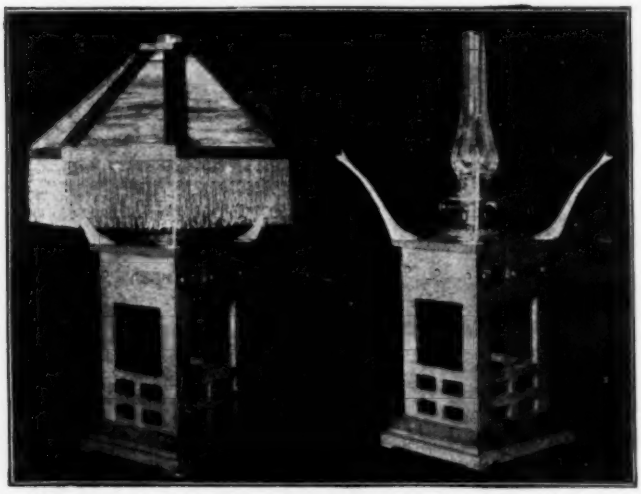
Valuable Pile of Oyster Shells

ELASTIC CONCRETE BRIDGE

The bridge shown in the illustration was built by the Pennsylvania State Highway Department in Washington county, Pa., and spans a deep cut made

Built by State of Pennsylvania

by the Pennsylvania Railroad company in building its branch to the famous Marianna mine, the scene of a recent mine disaster. The bridge is an elastic arch structure, 90 ft. high, 36 ft. wide and having a total floor length of 140 ft. The arch is parabolic in form, and has a span of about 97 ft., with a rise of about 36 ft. The structure is supported by three parallel arch ribs, rigidly fixed at both ends and having no hinges or joints. The bridge floor is composed of concrete slabs, 7 in. thick and 9 ft., 10 in. by 9 ft., 8 in.



Artistic Mission Style Oil Lamp

In testing the bridge a mistake on the part of the field force led to a load being placed on it weighing about six times the load with which it was intended to make the test, but the total deflection was only five-sixteenths of an inch. After the removal of the load the bridge returned to its normal position, showing that the elastic limit had not been reached. The bridge cost $16,480.

A new gem recently discovered in California has been given the name "Benitoite," after the county in which it was found. It is of a sapphire color, hard and remarkably brilliant, and is found in rock pockets. The new stone ranks with the less costly gems.

HOW TO MAKE A MISSION OIL LAMP

Electricity and gas are not always accessible in suburban or country homes and the regular type of a mission lamp would be of little use. The illustration shows an ordinary round wick kerosene lamp fitted out in mission style.

A few modifications were made in the design of an expensive lamp to simplify the construction. The lamp should have a tall chimney. The dimensions given in the drawings, and the photograph, will explain themselves. Many of the details can be worked up by the maker.

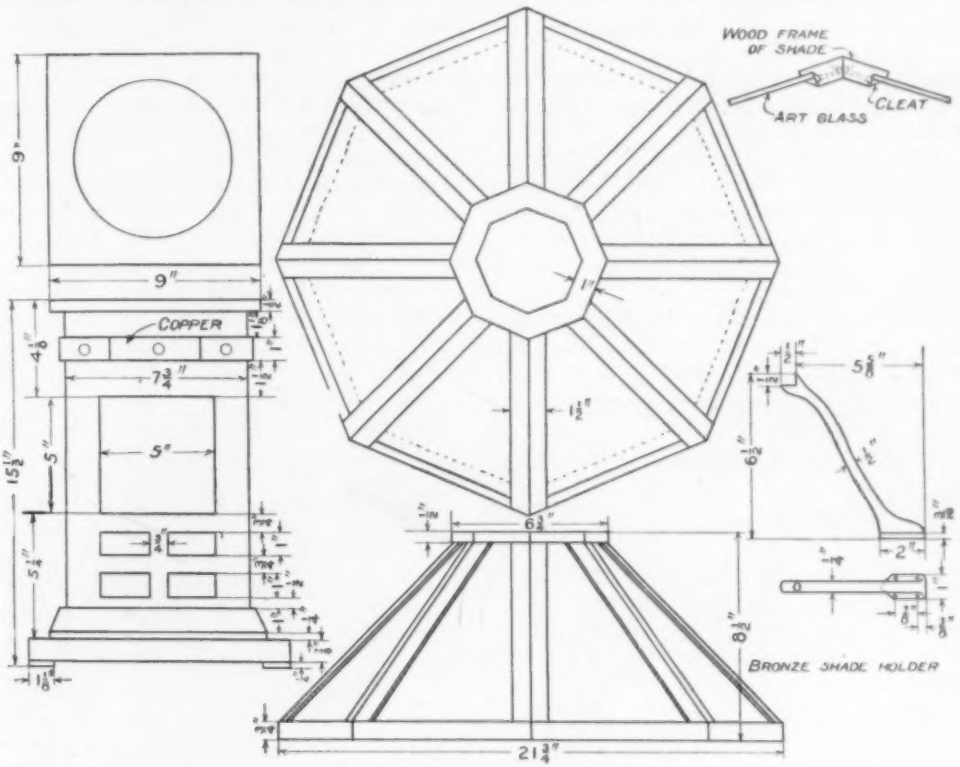
The body of the lamp is made of ½-in. oak and is provided with openings as shown. The interior receptacle is very handy for holding a match box, smoking articles, etc.

A piece of copper band, 1 in. wide, is fastened to the body with large upholsterers' tacks, to give it a finished appearance. The base is ⅞ in. thick and in order to prevent tilting is provided with four square feet, ¼ in. thick. The top piece of the body is ½-in. oak, which is provided with a hole large enough to receive the bowl of the lamp. If such a lamp is not at hand, one can be purchased at a very reasonable price.

The shade is made of oak frames set in with clouded art glass panels. The different sections of the frames are fastened together with brass screws and the glass is held in place by triangular cleats of oak. Be sure and fit the shade with cardboard panels before ordering the glass. The cardboard can be used as a pattern in cutting the glass, and the glass will then fit without recutting, which is quite difficult.

The glass beaded fringe should be of suitable color to harmonize with the finished lamp.

The shade is supported by four brackets cast in bronze from a wood pattern (dimensions given) and finished by filing, buffing and lacquering.



Details of Mission Lamp Construction

DELIVERY OF COAL BY NIGHT

One Solution of Problem of Relieving Traffic Congestion in Large Cities Meets Approval of Police Chiefs and Coal Company

The congested condition of traffic in the downtown districts of the larger cities of the country presents a problem which may demand many years of study, and an expenditure of many millions of dollars, before the final solution is reached. Freight tunnels, such as now underlie the streets in Chicago's loop district, solve the problem in part, but tunnels and subways are too costly to be practical of operation by either the municipality or private interests in many cities, and even with plans for such an expenditure, completion is a matter of years.

In the meantime, every effort should be made to devise practical ways of lessening the traffic congestion, one of which is the delivery of coal by night. Such a plan, if all interests concurred, would seem to be practical, and how the idea appeals to five chiefs of police and one of the largest coal companies in the west is expressed in the following extracts from letters received from Minneapolis, St. Louis, Cincinnati, Pittsburg, New York, and Chicago:

"We have not considered the night delivery of coal in our business district. In my opinion the idea is good and the adoption would improve the situation in the congested business districts of large cities."—Frank T. Corriston, superintendent of police, Minneapolis.

"St. Louis has no law compelling night deliveries of coal and so far as I am aware the practice is not in vogue

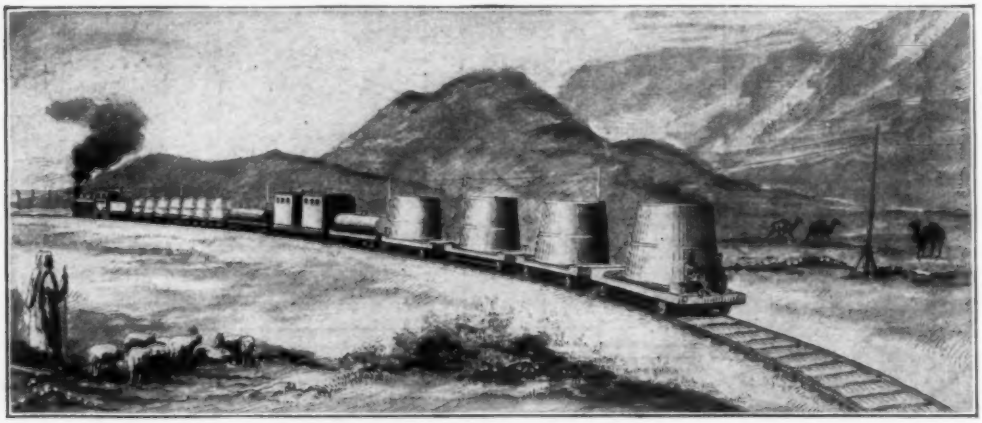
here. I have no doubt, however, but this plan would be of benefit in the congested districts."—E. P. Creecy, chief of police, St. Louis.

"There is nothing of this kind being done here now, but if the streets become more congested in the future, something of this kind would have to be done."—Paul M. Milliken, chief of police, Cincinnati.

"I beg to advise that coal is delivered to several of the largest office buildings during the night in this city, but there is no concerted general delivery of the same."—Thos. A. McQuaide, chief of police, Pittsburg.

"It is not customary to deliver coal at night. However, no law is known which prohibits it, except that if it should disturb the comfort or repose of a considerable number of persons, it would constitute a public nuisance."—F. H. Burgher, first deputy police commissioner, New York City.

"We believe that the deliveries of coal by night in the heart of the city would greatly relieve the congestion of traffic on the downtown streets. It is impossible, however, to inaugurate such a system without the co-operation of our customers, and we are writing this letter simply to get the opinion of those to whom we are delivering coal, as to whether it would be feasible for them to receive coal at night. It will, of course, be impossible for us to inaugurate this system unless a large percentage of our downtown customers maintain facilities for receiving coal at night. You, of course, will understand that if we start such a system we will have to employ a double force at our delivery yards, at a large additional expense, therefore we are anxious to get correct information on this subject. The police traffic squad are doing such excellent service towards the relieving of congestion, that we feel that if there is any way that large handlers of traffic in this city can help, we want to do so. Our load deliveries in the heart of the city at the present time are running over 400 loads per day. If these loads could be delivered at night, it ought certainly to help relieve the congestion."—City Fuel Co., Chicago.



A Train of Water in Asia

WATER-TRAIN ON THE TRANS CASPIAN RAILROAD

During the many years that Russia has been gradually extending the trans-Caspian railroad into its vast Asiatic territory north of China a great scarcity of water for men and locomotives was one of the problems to be continually fought. The difficulty was solved by bringing salt water from the Caspian Sea, and condensing it at points where it was needed. Later, the condensing was done on the Caspian shore, and the fresh water was transported in huge cistern tanks, each containing 1,000 gal. Long trains of such tanks had to proceed across the steppés.

CLOCK CASE MADE OF BICYCLES

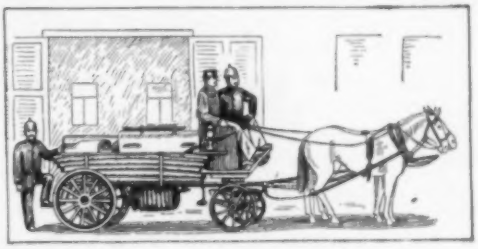
An ingenious Frenchman has constructed a clock, the structural work of which is of bicycle parts. It stands 12 ft. high, and the framework is a huge bicycle wheel, around which are arranged 12 ordinary-sized wheels, fitted with pneumatic tires. A rim within the large wheel bears the figures for the hours, the figures themselves being constructed of crank rods. The hands are made of bicycle-frame tubing, and the minute strokes on the dial are small nickel-plated pieces. The top of the clock is an arrangement of 12 handlebars, and the hours and quarter hours are struck by bicycle bells. The pendulum, also, is made of bicycle parts.

AUSTRIAN FIRE ENGINE OPERATED BY ELECTRICITY

The newest departure in Austrian fire apparatus is a fire engine which, although drawn by horses, is equipped with an electrically-driven turbine pump, the current being provided by tapping electric circuits in the vicinity of a fire. This connection is made by means of plug contacts, or by hook couplings consisting of metal roughened on the inside so as to remove the oxidized skin of wires to obtain satisfactory contact. The hook contacts are used only in connection with overhead conductors, and are readily fixed at any point on a line without disturbance to the regular service. The plug contacts are used in connection with underground circuits, the necessary contact boxes being installed close to the water hydrants.

The turbine pump, the 10-hp. 150-volt motor, and the necessary accessories are mounted upon a truck in so compact a form that space is also provided for seven firemen, the whole being drawn by two horses. A drum carries about 1,000 ft. of cable so that the engine can be operated, within that limit, at any place desired.

In recent tests the pump proved its ability to throw two streams of water a distance of 130 ft. A stream nearly 200 ft. high has been thrown in less than two minutes after arrival at a fire.



An Electric Fire Engine

The main advantages of such an engine are claimed to be increased rapidity in getting to work, reduction in first cost, reduction in weight and space requirements, increased simplicity and safety in operation, reduction in the wear and tear, and reduction in the cost of operation.

PHONOGRAPHIC CASH REGISTER

A cash register that announces the amount of a sale in human voice, as well as registering the figures, has been devised by a Minnesota inventor. When the keys are touched for a sale of, say, $1.65, certain phonographic reproducers are released and the machine sings out: "One-six-five." Such expressions as "thank you," or "I think you will find these goods satisfactory" may be added to the announcement of the sale.

The Superior court at Anderson, Ind., has decided that the Hepburn railroad act is a prospective and not retrospective law, and that a life pass issued before the law went into effect is still good.

MARKETING EDAM CHEESE

The illustration does not show a war scene in a beleaguered town with cannon balls stacked up in the foreground, but a peaceful market scene in Edam, Holland. The imitation cannon balls are Edam cheese ready for market, and the persons shown are only interested in buying and selling.—Photo by Miss Beatrice Oliver.

Market Scene in Holland

THE VALUE OF OLD TIN CANS

Few things are regarded as less valuable by the average citizen than the discarded tin can, but nevertheless the most battered is of no inconsiderable value and nothing but the label is useless, and even this may find its way into a market with other refuse paper.

The old tin cans of a city find their way to the ash dumps, from which they are carefully collected by professional scavangers, who know where to find factories exclusively engaged in the converting of just such material. The first process that turns the old can into a new one, or into something else, is the exposing of them to a high heat, which melts the solder. This runs off into a receptacle and is sold for 12 cents per pound.

By this means the tops and bottoms of the cans are likewise removed, and subsequently are smashed into a homogeneous mass by a steam hammer and cut up into sash weights for windows. Cans which are in first-class second-hand condition have only the tops unsoldered, and with new bottoms and tops added are utilized as receptacles for paints and varnishes. The cylindrical parts of cans are usually more or less dented and battered, but this is not a drawback of much importance. Rolled out perfectly flat by machinery, they serve extensively as roofing material for small buildings, and for covering the bottoms and corners of trunks.

That the old tin can is a means of revenue for the municipality has been recognized by at least one city. Liverpool, Eng., has one plant for its utilization, and last year cleared $900. Another and larger plant is now being built and the health commission of that city expects the revenue to reach a figure not less than $3,000 a year.

The chief cause of breakage of the porcelain insulator of spark plugs is screwing them in too tight while the cylinders are cold.